KAWA ELECTRONIC RESEARCH & DEVELOPMENT CENTRE

Service Manual

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In House Model No. : LCT32AD
Customer Model No. : LCT32HA36

BOM No : LCT32ADNIA1CS -B01 / LCT32ADAIA1CS-F01

Description : Service Manual for LCT32HA36 _CMO_USA

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SERVICE MANUAL

Model: LCT32HA36

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This manual is the latest at the time of printing, and does not include the modification which may be made after the printing, by the constant improvement of product.

I. Safety Instructions

CAUTION

RISK OF ELECTRIC SHOCK DO NOT OPEN

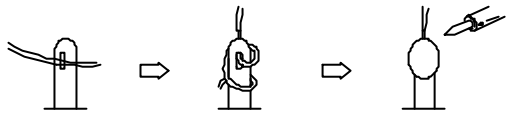
CAUTION: TO REDUCE THE RISK OF ELECTRIC SHOCK, DO NOT REMOVE COVER (OR BACK). NO USER-SERVICEABLE PARTS INSIDE. REFER SERVICING TO QUALIFIED SERVICE PERSONNEL ONLY.

The lightning flash with arrowhead symbol, within an equilateral triangle, is intended to alert the user to the presence of uninsulated " dangerous voltage" within the product' s enclosure that may be of sufficient magnitude to constitute a risk of electric shock to persons.

The exclamation point within an equilateral triangle is intended to alert the user to the presence of important operating and maintenance (servicing) instructions in the literature accompanying the appliance.

PRECAUTIONS DURING SERVICING

1. In addition to safety, other parts and assemblies are specified for conformance with such regulations as those applying to spurious radiation. These must also be replaced only with specified replacements. Examples: RF converters, tuner units, antenna selection switches, RF cables, noise-blocking capacitors, noise-blocking filters, etc.
2. Use specified internal Wiring. Note especially:
   1) Wires covered with PVC tubing
   2) Double insulated wires
   3) High voltage leads
3. Use specified insulating materials for hazardous live parts. Note especially:
   1) Insulating Tape
   2) PVC tubing
   3) Spacers (insulating barriers)
   4) Insulating sheets for transistors
   5) Plastic screws for fixing micro switches
4. When replacing AC primary side components (transformers, power cords, noise blocking capacitors, etc.), wrap ends of wires securely about the terminals before soldering.



5. Make sure that wires do not contact heat generating parts (heat sinks, oxide metal film resistors, fusible resistors, etc.)
6. Check if replaced wires do not contact sharply edged or pointed parts.
7. Make sure that foreign objects (screws, solder droplets, etc.) do not remain inside the set.

MAKE YOUR CONTRIBUTION TO PROTECT THE ENVIRONMENT

Used batteries with the ISO symbol for recycling as well as small accumulators (rechargeable batteries), mini-batteries (cells) and starter batteries should not be thrown into the garbage can.

Please leave them at an appropriate depot.

WARNING:

Before servicing this TV receiver, read the X-RAY RADIATION PRECAUTION, SAFETY INSTRUCTION and PRODUCT SAFETY NOTICE.

X-RAY RADIATION PRECAUTION

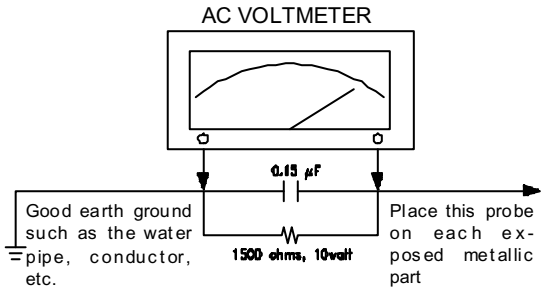
1. Excessively high can produce potentially hazardous X-RAY RADIATION. To avoid such hazards, the high voltage must not exceed the specified limit. The normal value of the high voltage of this TV receiver is 27 KV at zero bean current (minimum brightness). The high voltage must not exceed 30 KV under any circumstances. Each time when a receiver requires servicing, the high voltage should be checked. The reading of the high voltage is recommended to be recorded as a part of the service record, It is important to use an accurate and reliable high voltage meter.
2. The only source of X-RAY RADIATION in this TV receiver is the picture tube. For continued X-RAY RADIATION protection, the replacement tube must be exactly the same type as specified in the parts list.
3. Some parts in this TV receiver have special safety related characteristics for X-RADIATION protection. For continued safety, the parts replacement should be under taken only after referring the PRODUCT SAFETY NOTICE.

SAFETY INSTRUCTION

The service should not be attempted by anyone unfamiliar with the necessary instructions on this TV receiver. The following are the necessary instructions to be observed before servicing.

1. An isolation transformer should be connected in the power line between the receiver and the AC line when a service is performed on the primary of the converter transformer of the set.
2. Comply with all caution and safety related provided on the back of the cabinet, inside the cabinet, on the chassis or picture tube.
3. To avoid a shock hazard, always discharge the picture tube's anode to the chassis ground before removing the anode cap.

4. Completely discharge the high potential voltage of the picture tube before handling. The picture tube is a vacuum and if broken, the glass will explode.
5. When replacing a MAIN PCB in the cabinet, always be certain that all protective are installed properly such as control knobs, adjustment covers or shields, barriers, isolation resistor networks etc.
6. When servicing is required, observe the original lead dressing. Extra precaution should be given to assure correct lead dressing in the high voltage area.
7. Keep wires away from high voltage or high tempera ture components.
8. Before returning the set to the customer, always perform an AC leakage current check on the exposed metallic parts of the cabinet, such as antennas, terminals, screwheads, metal overlay, control shafts, etc., to be sure the set is safe to operate without danger of electrical shock. Plug the AC line cord directly to the AC outlet (do not use a line isolation transformer during this check). Use an AC voltmeter having 5K ohms volt sensitivity or more in the following manner.
   Connect a 1.5K ohm 10 watt resistor paralleled by a 0.15µF AC type capacitor, between a good earth ground (water pipe, conductor etc.,) and the exposed metallic parts, one at a time.
   Measure the AC voltage across the combination of the 1.5K ohm resistor and 0.15 uF capacitor. Reverse the AC plug at the AC outlet and repeat the AC voltage measurements for each exposed metallic part.
   The measured voltage must not exceed 0.3V RMS. This corresponds to 0.5mA AC. Any value exceeding this limit constitutes a potential shock hazard and must be corrected immediately.
   The resistance measurement should be done between accessible exposed metal parts and power cord plug prongs with the power switch "ON". The resistance should be more than 6M ohms.


AC VOLTMETER
0.15 µF
Good earth ground such as the water pipe, conductor, etc.
1500 ohms, 10watt
Place this probe on each exposed metallic part
AC Leakage Current Check

PRODUCT SAFETY NOTICE

Many electrical and mechanical parts in this TV receiver have special safety-related characteristics. These characteristics are offer passed unnoticed by visual spection and the protection afforded by them cannot necessarily be obtained by using replacement components rates for a higher voltage, wattage, etc. The replacement parts which have these special safety characteristics are identified by ⚠ marks on the schematic diagram and on the parts list. Before replacing any of these components, read the parts list in this manual carefully. The use of substitute replacement parts which do not have the same safety characteristics as specified in the parts list may create shock, fire, X-RAY RADIATION or other hazards.

1. Do not power on.

1.1 Please check AC cable if connect to AC plug.

Is true the connector don’t connect to AC plug. Please connect it.

2.2 Please check AC cable if connect to AC power.

Is true the AC cable don’t connect to AC power. Please connect it.

3.3 Please check power board of fuse if broken.

If the F1 fuse is broken, Please pull out the AC cable from AC power. Please check AC L power and AC N ground by multimeter, The read number is infinite, the fuse is broke. then look up power board if not burn out place. Is true it. Please change power board or be changed power board.

2. The power on switch of green extinguish.

2.1 The power of led(indicator light) is red light, To touch power on key when indicator light wink.

Is true that the power DC output have somewhere short circuit.

Please check connector J39,J31 .If not connector direction is wrong.

Or the mainboard somewhere of power short circuit.

3.The power is normal work ,but don’t backlight.

3.1 The indicator light work normal (green light).

Please check Main board of transistor Q18 collect if not has +5v voltage.

Is true Q18 collect hasn’t +5v ,To check Q18 if fail. Or to check Q18 of base if not low. (Low is working, high don’t work).

Please refer to attached sheet A circuit diagram.

3.2 Please check backlight of connector if not it direction is wrong or the connector of wire compositor direction is wrong.

3.3 To check connector panel of voltage is +24v. It’s true .Then to check of the first pin if it have +5V voltage, It’s true , than to check power board of +24v voltage ,It’s true. The panel of backlight board is fail. The change panel of backlight board.

Please refer to attached sheet B Panel of datasheet.

4.The screen don’t have picture But have backlight.

4.1 To check to panel of voltage ,To check main board of bead L69 and L57 connect if not OK.Then check the L69 and L57 of voltage is +12v(27 inch panel voltage is +5v, To check L68 and L56) . Next to check fuse F1 and connector J10 if not is +12v(27 inch panel voltage is +5v). If isn’t please check power board of connector CON5 if has +12v(27 inch panel voltage is +5v).

4.2To check to main board +12 V voltage. To check to main board IC U35 of the first pin if

+5v voltage ,It’s fail. It’s low (close 0 v) working.

The circuit diagram follow down:

Please refer to attached sheet A circuit diagram.

5.The remote control don’t be control.

6.1 The check batteries of remote control if it run out of .

6.2 To check main board of connecter J21 of wire connect fastness and the connecter of wire open.

Please refer to attached sheet A circuit diagram.

6.The sound don’t output.

7.1 To check main board +24v voltage of connector J8 ,It’s true not +24v voltage. Then to to check power main +24v fail .

Please refer to attached sheet A circuit diagram.

7.The DTV don’t detect .

7.1 To check mainboard of connecter J24 and DTV mainboard of connector HA1 of FCC wire if no connect fastness.

Please refer to attached sheet C of DTV circuit diagram.

Technical Specification

Product Model:	LCT32HA36
Screen Size:	32” diagonal
Screen Area:	708.954mm(H) x 398.592mm(V)
Aspect Ratio:	16:9
External Size:	787mm(W) x 618mm(H) x 240mm(D) (with Stand)
Net Weight:	15.2kg (with Stand)
Resolution:	1366 (H) x 768 (V) pixels (Each pixel has R/G/B 3 color cells)
Pixel Pitch:	173.0μm(H) x519.0μm(V)
Color:	16.7 millions of colors (R/G/B each 256 scales)
Gray Scale:	256 (R/G/B each 8-bit)
Peak brightness:	500cd/m^2
Contrast (Dark Room):	1000:1 (Typical)
TV System:	NTSC M, ATSC
Sound:	Mono, Stereo, SAP (BTSC)
Sound Effect:	Acoustic Cinema Enhancement
Power Supply:	AC 120V, 60Hz
Power Consumption:	200W
Input/Output Terminal:	Antenna Input (F Type) x 2 (NTSC & ATSC)
	RS-232 (D-Sub 9 Pin Type) x 1 (Only for DTV)
	VGA (D-Sub 15 Pin Type) x 1
	HDMI (Ver 1.1) connector x 1
	Component Video - YPbPr x 2 (RCA Terminals)
	Video Input (RCA Terminals) x 1
	S-Video Input Mini Din 4 Pin Terminal x 1
	Stereo, Audio x 5
	1 set of Audio Output terminals (RCA, L&R)
Agent System:	UL, cUL, FCC

NOTE:

- *The specifications shown above may be changed without notice for quality improvement.*

Support the Signal Mode

A. D-Sub Mode (VGA)

Resolution	Horizontal Frequency (kHz)	Vertical Frequency (Hz)
640 x 480	31.50	60.00
	37.86	72.81
800 x 600	35.16	56.25
	37.90	60.32
	48.08	72.19
1024 x 768	48.40	60.00

B. HDTV Mode (YPbPr)

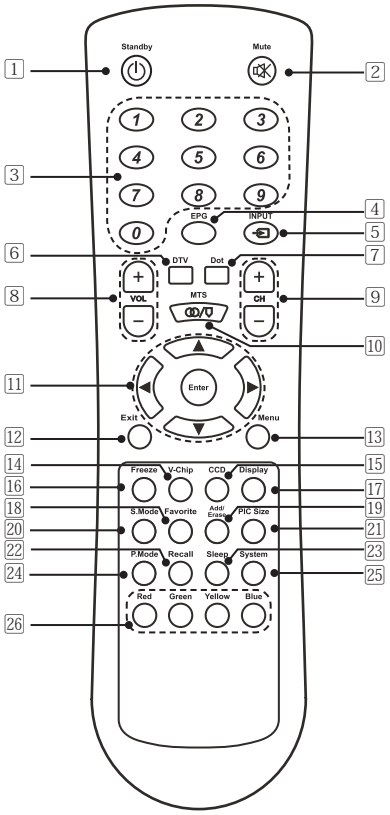
Resolution	Horizontal Frequency (kHz)	Vertical Frequency (Hz)
480i	15.734	59.94
480p(720x480)	31.468	59.94
720p(1280x720)	45.00	60.00
1080i(1920x1080)	33.75	60.00

C. HDMI Mode

Resolution	Horizontal Frequency (kHz)	Vertical Frequency (Hz)
480p	31.468	59.94
720p	45.00	60.00
1080i	33.75	60.00

- When the signal received by the Display exceeds the allowed range, a warning message shall appear on the screen.
- You can confirm the input signal format from the on-screen.

Remote Control



1 **Power** (⏻): Press to turn on andoff.
2 **Mute** (🔇): Press to mute the sound. Press again or press **VOL**+/- to restore the sound.
3 **0~9 Number Buttons**: In TV mode, press 0~9 to select a channel; the channel changes after 2 seconds.
4 **EPG**: Press to display EPG (Electronic Program Guide) menu.
5 **INPUT** (⏏): Press to select the signal sources.
6 **DTV**: Press to select Digital TV mode.
7 **Dot**: Press number buttons with it to select the channels directly in DTV.
8 **VOL +/-**: Press to adjust the volume.
9 **CH +/-**: Press to changes channels.
10 **MTS**: Press to repeatedly to cycle through the Multi-channel TV sound (MTS) options. Such as Stereo, Mono, or Separate Audio Program (SAP broadcast).
11 ◀,▲,▼,▶, **Enter**: Press ◀,▲,▼,▶ to move the on-screen cursor. To select an item, press **Enter** to confirm.
12 **Exit**: Press to return or exit the OSD menu.
13 **Menu**: Press to display the OSD menu.
14 **V-Chip**: Press to select the child protect mode.
15 **CCD**: Press to select the Closed Caption mode.
16 **Freeze**: Press to freeze the picture, press again to restore the picture. (This button is not available for VGA mode.)
17 **Display**: Press to display the channel information and it disappear after 3 seconds.
18 **Favorite**: Press repeatedly to cycle through the favorite channel list.
19 **Add/Erase**: Press to add or delete favorite channel.
20 **S.Mode**: Adjust the TV sound by selecting one of the preset factory settings, such as Normal, News, Cinema, Concert, or User.
21 **PIC.Size**: Press to change the screen size, such as Full, 4:3, Panoramic. (Note: In VGA mode, it can select picture size is Full. While in DTV mode, it can select picture size is: Full and 4:3.)
22 **Recall**: Press to return to previous channel.
23 **Sleep**: Press to sleep a time for the TV to turn off automatically, such as 15Min, 30Min, 60Min, 90Min, 120Min and, OFF. To cancel sleep time, press Sleep repeatedly until sleep OFF appears.
24 **P.Mode**: Adjust the TV picture by selecting one of the preset factory settings, such as Hi-Bright, User, Cinema, Normal and Vivid.
25 **System**: Press repeatedly to cycle through the system options: AUTO, NTSC3.58 and PAL.(This button is activate for AV, S-Video input source.)
26 **Color Buttons**:
Red: Press this button to access the red item or page.
Blue: Press this button to access the blue item or page.
Green: Press this button to access the green item or page.
Yellow: Press this button to access the yellow item or page.

Optical Output

Flash 32mb

MT5351 MPEG Decoder

DDR 256M

DDR 256M

TD1336 Digital Tuner

X6965D SAW Filter

MT5111 DTV Demodulator

DTV BOARD

POWER BOARD

5V

Standby 5V

12V

9V

24VA (For Class D)

24V (For LCD Panel)

MAIN BOARD

HDMI

MT8293 HDMI Receiver

74L VC245A X4 24 bit RGB Switch

Analog Tuner

To panel

YPbPr1

YPbPr2 (Option)

QS3VH257 Switch(Option)

MT8202 ADC & Scaler & LVDS Transfer

Flash 8M/16M

VGA

NJRC4558 Audio Buffer

Audio Output

AV

DDR 128M

S-Video

DDR 128M

Audio X2

HEF4052 Switch

WM8776 Audio ADC&DAC

Max232 Level Shift

RS232 Socket

Audio X3

R2S15102 Class D Amplifier

Relay

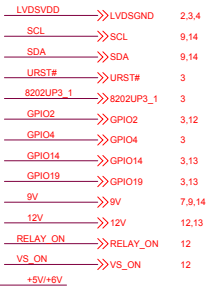
Speaker

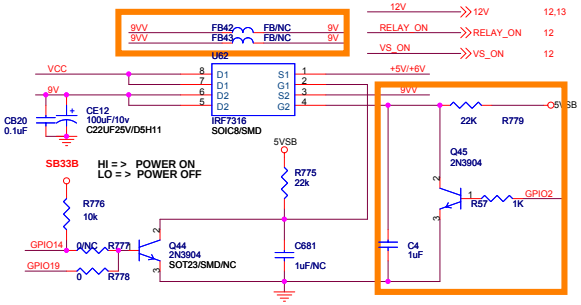
LCD panel

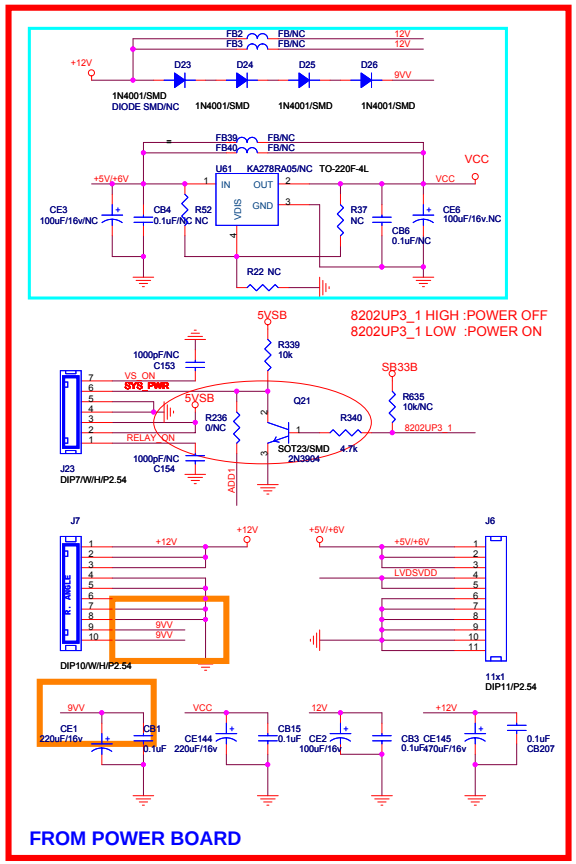
MT8202E (PBGA388) LCDTV BOARD 4 LAYERS FOR AKAI

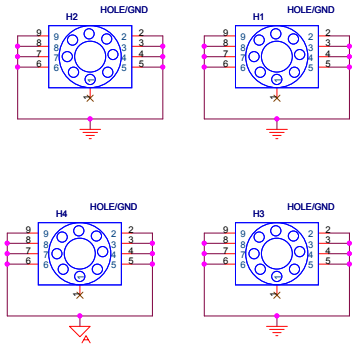
1. INDEX / POWER / RESET / EEPROM
2. LDO
3. MT8202E PBGA388
4. MT8202 DECOUPLING
5. DDR MEMORY & FLASH
6. MT5351 INTERFACE
7. HDMI MT8293
8. DAUGHTER BOARD IN
9. WM8776 & VIDEO BYPASS
10. AUDIO / VIDEO IN CIRCUIT
11 . VGA & PC AUDIO IN
12. LVDS OUT
13. BACK LIGHT / KEYPAD
14. TUNER IN
15. AV IN
16. AUDIO IN
17.AUDIO Amplifier

Rev	History	P#	Date
AKAI_MT8202_27US_LVDS_V0.0	New		2005/11/22
AKAI_MT8202_27US_HDMI_LVDS_V0.0	ADD HDMI / VIDEO /AUDIO CONNECTOR INPUT IN		









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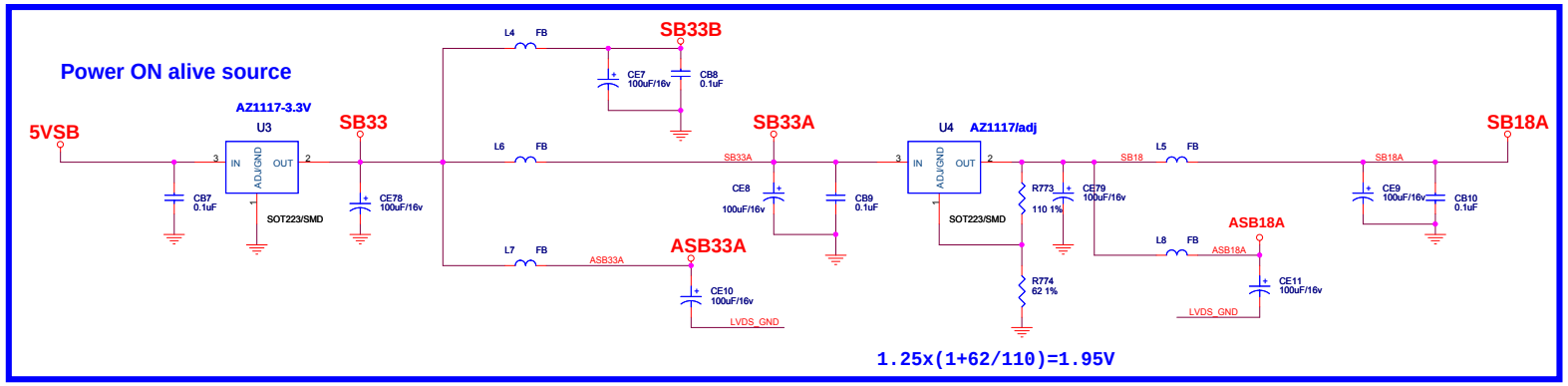
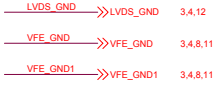
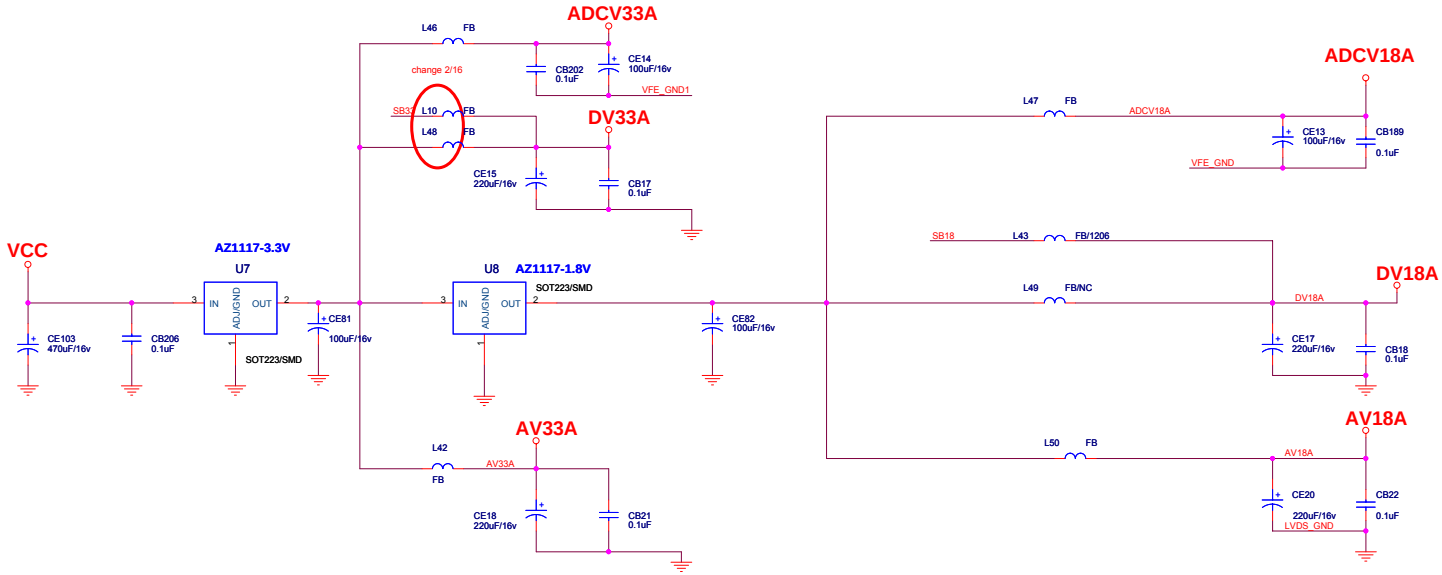
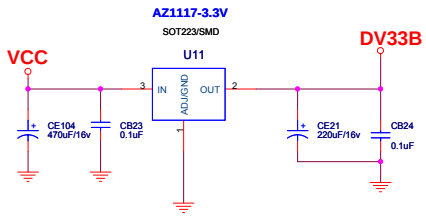
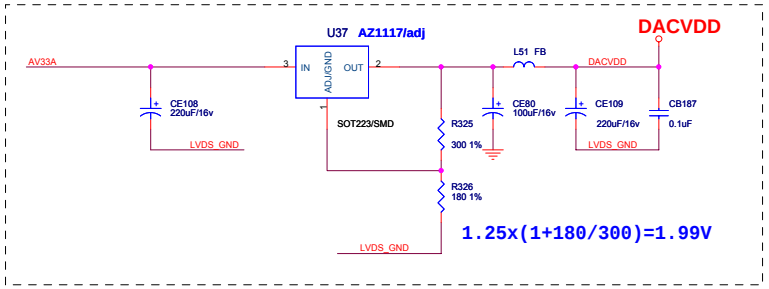
Date: Thursday, April 13, 2006		Sheet 1	17











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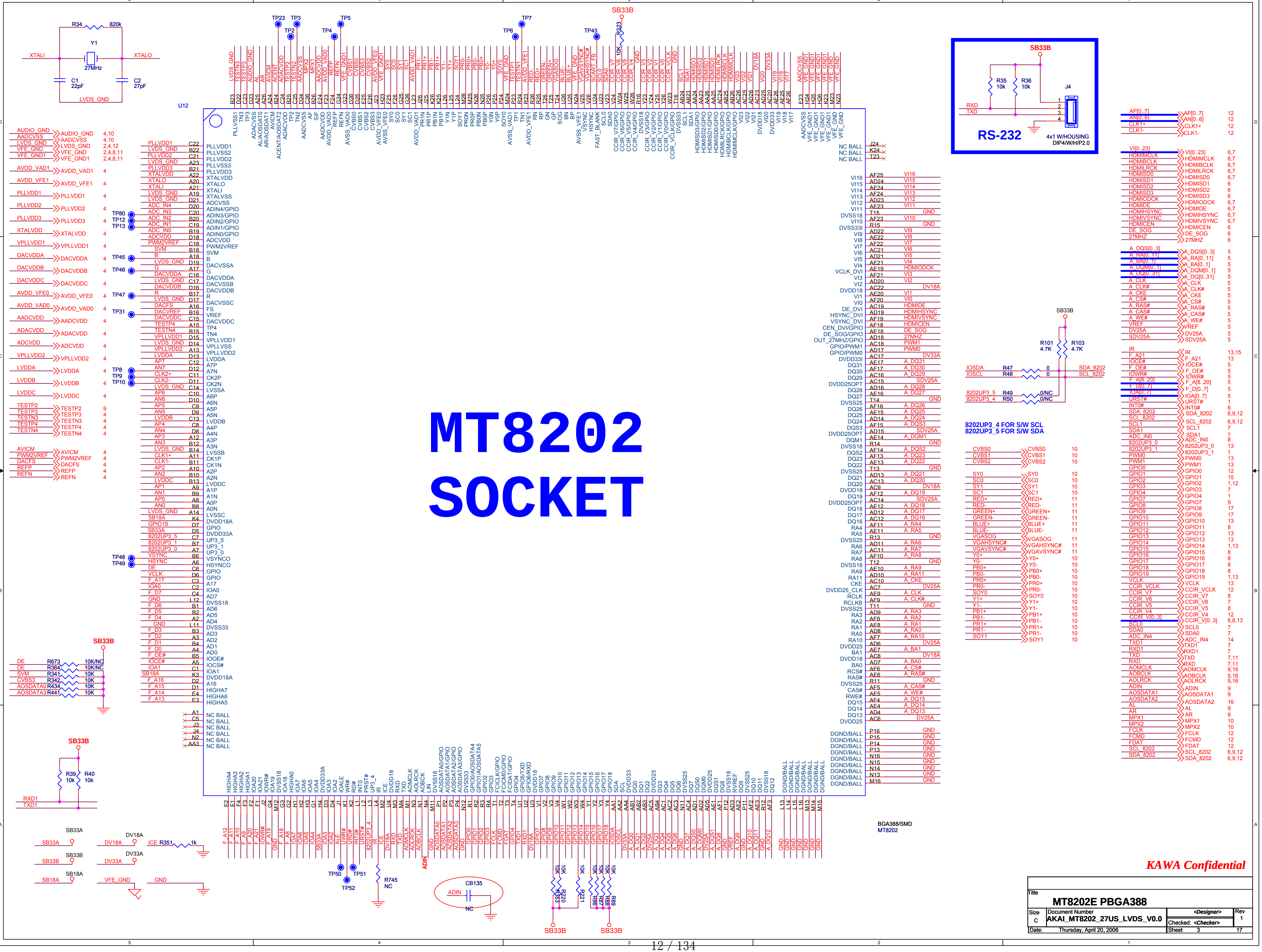

MT8202
SOCKET
U12
BGA388/SMD
MT8202
RS-232
SB33B
R35 10k
R36 10k
J4
RXD
TXD
4x1 W/HOUSING
DIP4/W/H/P2.0
Y1
27MHz
R34 820k
C1 22pF
C2 27pF
XTALI
XTALO
LVDS_GND
R101 4.7K
R103 4.7K
IOSDA R47 0 SDA_8202
IOSCL R48 0 SCL_8202
8202UP3_5 R49 0/NC
8202UP3_4 R50 0/NC
8202UP3_4 FOR S/W SCL
8202UP3_5 FOR S/W SDA
R673 10K/NC
R364 10K/NC
R341 10K
R342 10K
R434 10K
R441 10K
R39 10k
R40 10k
RXD1
TXD1
ICE R351 1k
R745 NC
CB135
ADIN
NC
SB33A
SB18A
DV18A
DV33A
VFE_GND
GND

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Document Number	AKAI_MT8202_27US_LVDS_V0.0
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LVDDB 3
LVDDC 3
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AVDD_VAD0 3
AADCVDD 3
ADACVDD 3
VPLLVDD1 3
VPLLVDD2 3
AVDD_VAD1 3
AVDD_VFE1 3
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PLLVDD2 3
PLLVDD3 3
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DACVDDB 3
DACVDDC 3
TESTP3 3
TESTN3 3
TESTP4 3
TESTN4 3
REFP 3
REFN 3
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AUDIO_GND 3,10
LVDS_GND 2,3,12
VFE_GND 2,3,8,11
AADCVSS 3,10
VFE_GND1 2,3,8,11

STANDBY ANALOG POWER

ASB18A

L12 FB
C5 4.7uF
CB26 0.1uF
XTALVDD
LVDS_GND

ASB33A

L13 FB
CE26 10uF/10V
C10 1uF
C11 4.7uF
CB29 0.1uF
ADCVDD
LVDS_GND

NORMAL VIDEO DAC POWER

DACVDD

CE28 10uF/10V
C14 1uF
FB5 FB BEAD/SMD/0603
C15 4.7uF
CB33 0.1uF
DACVDDA
FB6 FB BEAD/SMD/0603
C16 4.7uF
CB34 0.1uF
DACVDDB
FB8 FB BEAD/SMD/0603
C18 4.7uF
CB37 0.1uF
DACVDDC
LVDS_GND

NORMAL VIDEO DAC POWER

AV33A

FB10 FB BEAD/SMD/0603
C20 1uF
C21 4.7uF
CB40 0.1uF
LVDDA
C23 4.7uF
CB42 0.1uF
LVDDB
C25 4.7uF
CB45 0.1uF
LVDDC
LVDS_GND

NORMAL AUDIO ADC / DAC POWER

ADCV33A

L14 150uH L/IND/DIP/P10.0
CE33 10uF/10V
C27 1uF
CE34 470uF/16V
CB47 0.1uF
AADCVDD
AADCVSS

ADCV33A

L15 150uH L/IND/DIP/P10.0
CE35 10uF/10V
C28 1uF
CE36 470uF/16V
CB48 0.1uF
ADACVDD
AUDIO_GND

NORMAL ANALOG POWER

ASB18A

FB1 FB
CE24 10uF/10V
C6 1uF
C7 4.7uF
CB27 0.1uF
PLLVDD1
C9 4.7uF
CB28 0.1uF
PLLVDD2
CB30 0.1uF
PLLVDD3
LVDS_GND

AV18A

FB4 FB
CE27 10uF/10V
CB31 1uF
C13 4.7uF
CB32 0.1uF
VPLLVDD1
LVDS_GND

AV33A

FB7 FB
CE29 10uF/10V
CB35 1uF
C17 4.7uF
CB36 0.1uF
VPLLVDD2
LVDS_GND

NORMAL VIDEO ADC POWER

ADCV33A

FB9 FB
CE30 10uF/10V
CB38 1uF
C19 4.7uF
CB39 0.1uF
AVDD_VFE0
VFE_GND1
FB11 FB
C22 4.7uF
CB41 0.1uF
AVDD_VAD0
VFE_GND1

ADCV18A

FB13 FB
CE32 10uF/10V
CB43 1uF
C24 4.7uF
CB44 0.1uF
AVDD_VFE1
VFE_GND
FB15 FB
C26 4.7uF
CB46 0.1uF
AVDD_VAD1
VFE_GND

AVICM
CB25 0.1uF
C3 10uF/10v C0805/SMD
AUDIO_GND

PWM2VREF
CE25 47uF/16V
C8 0.1uF C0603/SMD
LVDS_GND

DACFS
R42 820
LVDS_GND

AADCVSS
AUDIO_GND

LVDS_GND L2 FB L3 FB

VFE_GND1
C51 10uF/10v C0805/SMD
REFP
C49 10uF/10v C0805/SMD
C173 0.1uF
C174 0.01uF
REFN
C50 10uF/10v C0805/SMD
VFE_GND1

TESTP3	R43	49.9 1%	PLLVDD1
TESTN3	R44	49.9 1%	PLLVDD1
TESTP4	R45	49.9 1%	VPLLVDD1
TESTN4	R46	49.9 1%	VPLLVDD1

MT8202 DIGITAL POWER & DECOUPLING

DV18A
CB52 0.1uF
CB53 0.1uF
CB54 0.1uF
C32 3300pF
C33 3300pF
C34 3300pF
SB33A
CB49 0.1uF
CB50 0.1uF
CB55 0.1uF
C29 0.01uF
C30 3300pF

PUT ON NEARLY BGA

5VSB
CE37 220uF/16v
CE38 220uF/16v
CB56 0.1uF
CB57 0.1uF
CB58 0.1uF
DV33A
CB59 0.1uF
CB60 0.1uF
CB61 0.1uF
SB18A
SB18A
C31 3300pF
CB51 0.1uF

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Title	MT8202 DECOUPLING		
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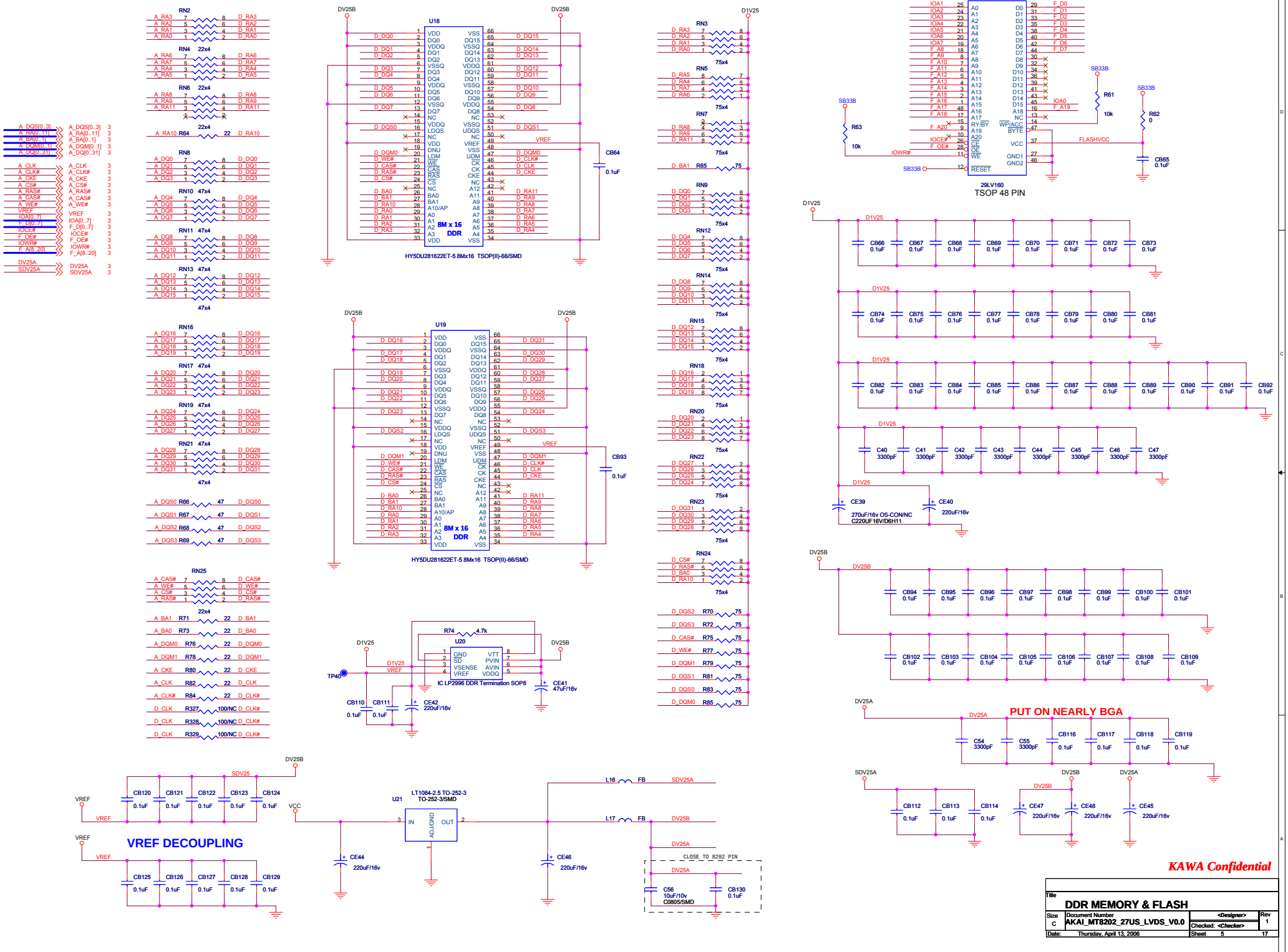
A_DQS[0..3]
A_RA[0..11]
A_BA[0..1]
A_DQM[0..1]
A_DQ[0..31]
A_CLK
A_CLK#
A_CKE
A_CS#
A_RAS#
A_CAS#
A_WE#
VREF
IOA[0..7]
F_D[0..7]
IOCE#
F_OE#
IOWR#
F_A[8..20]
DV25A
SDV25A
RN2
RN4 22x4
RN6 22x4
22x4
R64 22
RN8
RN10 47x4
RN11 47x4
RN13 47x4
47x4
RN16
RN17 47x4
RN19 47x4
RN21 47x4
47x4
R66 47
R67 47
R68 47
R69 47
RN25
22x4
R71 22
R73 22
R76 22
R78 22
R80 22
R82 22
R84 22
R327 100/NC
R328 100/NC
R329 100/NC
U18
HY5DU281622ET-5 8Mx16 TSOP(II)-66/SMD
8M x 16 DDR
CB64 0.1uF
U19
HY5DU281622ET-5 8Mx16 TSOP(II)-66/SMD
8M x 16 DDR
CB93 0.1uF
R74 4.7k
U20
IC LP2996 DDR Termination SOP8
TP40
CB110 0.1uF
CB111 0.1uF
CE42 220uF/16v
CE41 47uF/16v
VREF DECOUPLING
CB120 0.1uF
CB121 0.1uF
CB122 0.1uF
CB123 0.1uF
CB124 0.1uF
CB125 0.1uF
CB126 0.1uF
CB127 0.1uF
CB128 0.1uF
CB129 0.1uF
U21
LT1084-2.5 TO-252-3
TO-252-3/SMD
CE44 220uF/16v
CE46 220uF/16v
L16 FB
L17 FB
CLOSE TO 8202 PIN
C56 10uF/10v C0805/SMD
CB130 0.1uF
RN3
RN5
75x4
RN7
RN9
RN12
RN14
RN15
RN18
RN20
RN22
RN23
RN24
R65 75
R70 75
R72 75
R75 75
R77 75
R79 75
R81 75
R83 75
R85 75
U17
29LV160
TSOP 48 PIN
R63 10k
R61 10k
R62 0
CB65 0.1uF
CB66 0.1uF
CB67 0.1uF
CB68 0.1uF
CB69 0.1uF
CB70 0.1uF
CB71 0.1uF
CB72 0.1uF
CB73 0.1uF
CB74 0.1uF
CB75 0.1uF
CB76 0.1uF
CB77 0.1uF
CB78 0.1uF
CB79 0.1uF
CB80 0.1uF
CB81 0.1uF
CB82 0.1uF
CB83 0.1uF
CB84 0.1uF
CB85 0.1uF
CB86 0.1uF
CB87 0.1uF
CB88 0.1uF
CB89 0.1uF
CB90 0.1uF
CB91 0.1uF
CB92 0.1uF
C40 3300pF
C41 3300pF
C42 3300pF
C43 3300pF
C44 3300pF
C45 3300pF
C46 3300pF
C47 3300pF
CE39 270uF/16v OS-CON/NC C220UF16V/D6H11
CE40 220uF/16v
CB94 0.1uF
CB95 0.1uF
CB96 0.1uF
CB97 0.1uF
CB98 0.1uF
CB99 0.1uF
CB100 0.1uF
CB101 0.1uF
CB102 0.1uF
CB103 0.1uF
CB104 0.1uF
CB105 0.1uF
CB106 0.1uF
CB107 0.1uF
CB108 0.1uF
CB109 0.1uF
PUT ON NEARLY BGA
C54 3300pF
C55 3300pF
CB116 0.1uF
CB117 0.1uF
CB118 0.1uF
CB119 0.1uF
CB112 0.1uF
CB113 0.1uF
CB114 0.1uF
CE47 220uF/16v
CE48 220uF/16v
CE45 220uF/16v
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Title
DDR MEMORY & FLASH
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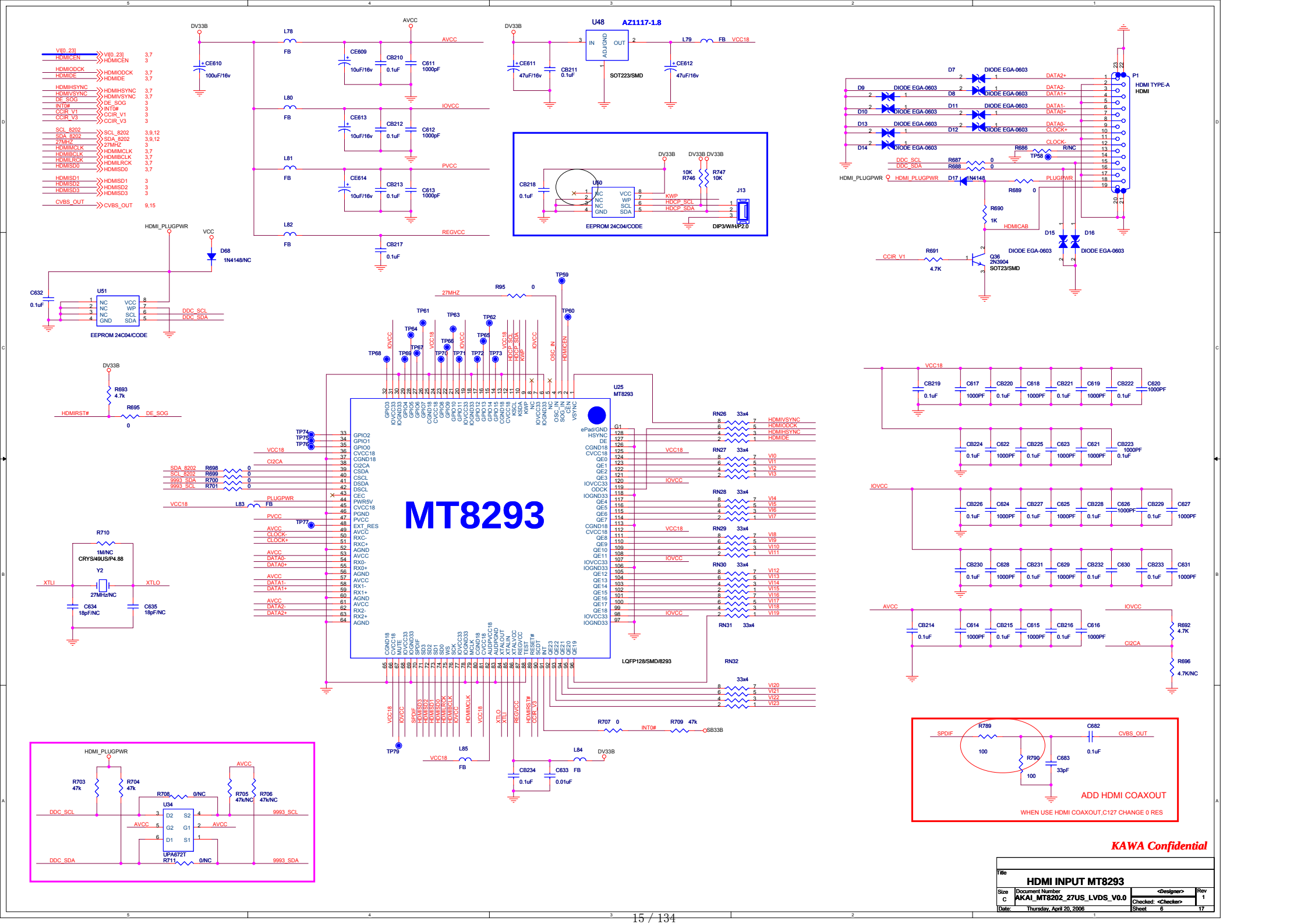
MT8293
U48 AZ1117-1.8
SOT223/SMD
EEPROM 24C04/CODE
DIP3/W/HP2.0
LQFP128/SMD8293
HDMI TYPE-A
HDMI
ADD HDMI COAXOUT
WHEN USE HDMI COAXOUT,C127 CHANGE 0 RES
KAWA Confidential
HDMI INPUT MT8293
Document Number
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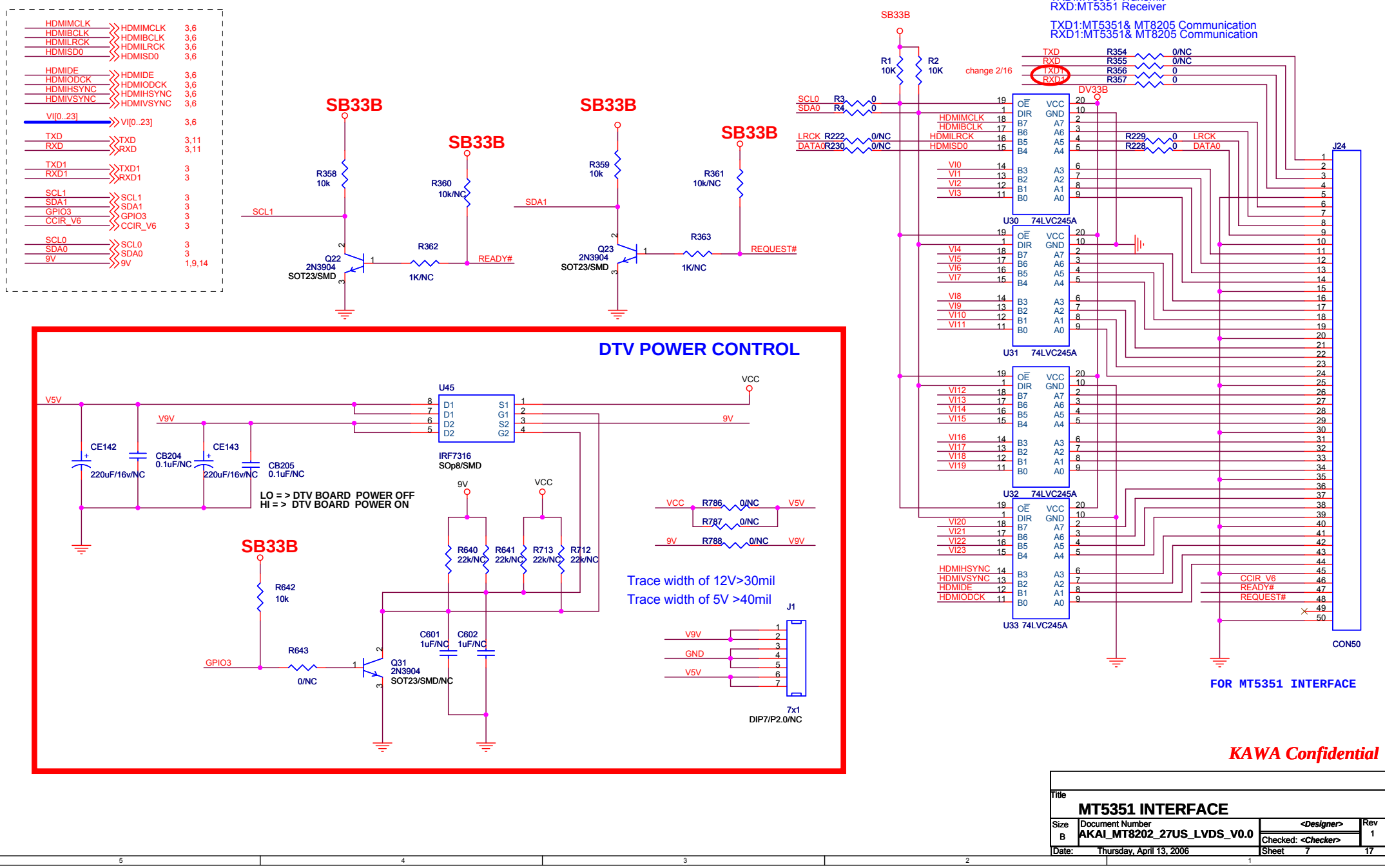
Thursday, April 20, 2006


HDMIMCLK HDMIMCLK 3,6
HDMIBCLK HDMIBCLK 3,6
HDMILRCK HDMILRCK 3,6
HDMISD0 HDMISD0 3,6
HDMIDE HDMIDE 3,6
HDMIODCK HDMIODCK 3,6
HDMIHSYNC HDMIHSYNC 3,6
HDMIVSYNC HDMIVSYNC 3,6
VI[0..23] VI[0..23] 3,6
TXD TXD 3,11
RXD RXD 3,11
TXD1 TXD1 3
RXD1 RXD1 3
SCL1 SCL1 3
SDA1 SDA1 3
GPIO3 GPIO3 3
CCIR_V6 CCIR_V6 3
SCL0 SCL0 3
SDA0 SDA0 3
9V 9V 1,9,14
SB33B
R358 10k
SCL1
Q22 2N3904 SOT23/SMD
R362 1K/NC
R360 10k/NC
READY#
R359 10k
SDA1
Q23 2N3904 SOT23/SMD
R363 1K/NC
R361 10k/NC
REQUEST#
DTV POWER CONTROL
V5V
V9V
U45 IRF7316 SOp8/SMD
CE142 220uF/16v/NC
CB204 0.1uF/NC
CE143 220uF/16v/NC
CB205 0.1uF/NC
LO = > DTV BOARD POWER OFF
HI = > DTV BOARD POWER ON
VCC
9V
R640 22k/NC
R641 22k/NC
R713 22k/NC
R712 22k/NC
R642 10k
R643 0/NC
GPIO3
Q31 2N3904 SOT23/SMD/NC
C601 1uF/NC
C602 1uF/NC
R786 0/NC
R787 0/NC
R788 0/NC
Trace width of 12V>30mil
Trace width of 5V >40mil
J1
7x1 DIP7/P2.0/NC
TXD:MT5351 Transmit
RXD:MT5351 Receiver
TXD1:MT5351& MT8205 Communication
RXD1:MT5351& MT8205 Communication
R1 10K
R2 10K
change 2/16
R354 0/NC
R355 0/NC
R356 0
R357 0
DV33B
SCL0 R3 0
SDA0 R4 0
LRCK R222 0/NC
DATA0 R230 0/NC
R229 0 LRCK
R228 0 DATA0
U30 74LVC245A
U31 74LVC245A
U32 74LVC245A
U33 74LVC245A
J24
CON50
CCIR_V6
READY#
REQUEST#
FOR MT5351 INTERFACE
KAWA Confidential
Title
MT5351 INTERFACE
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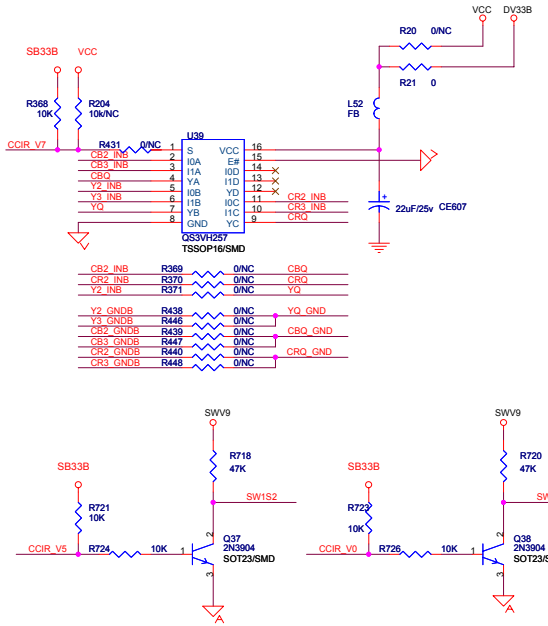
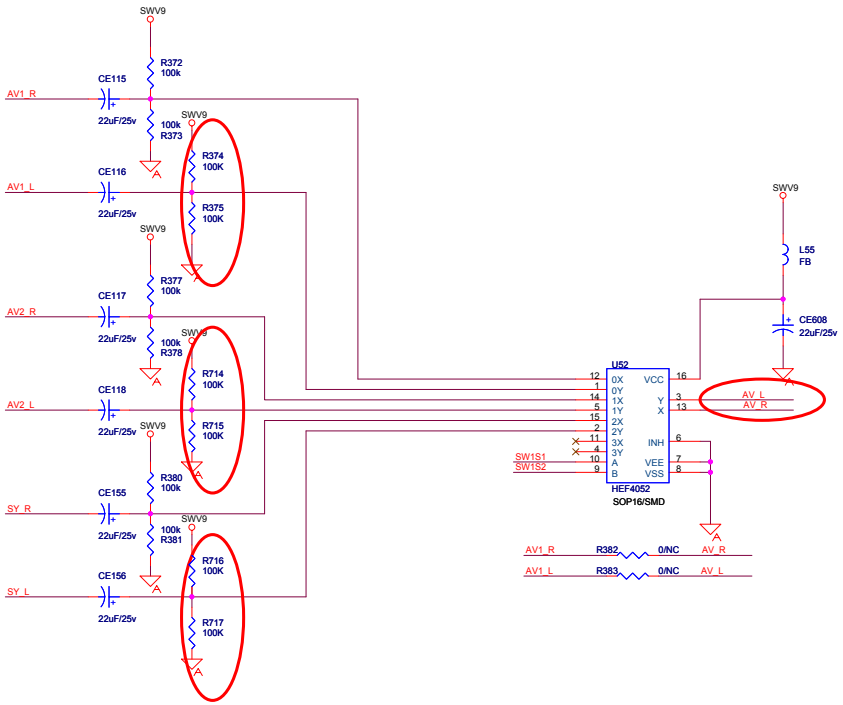
INPUT

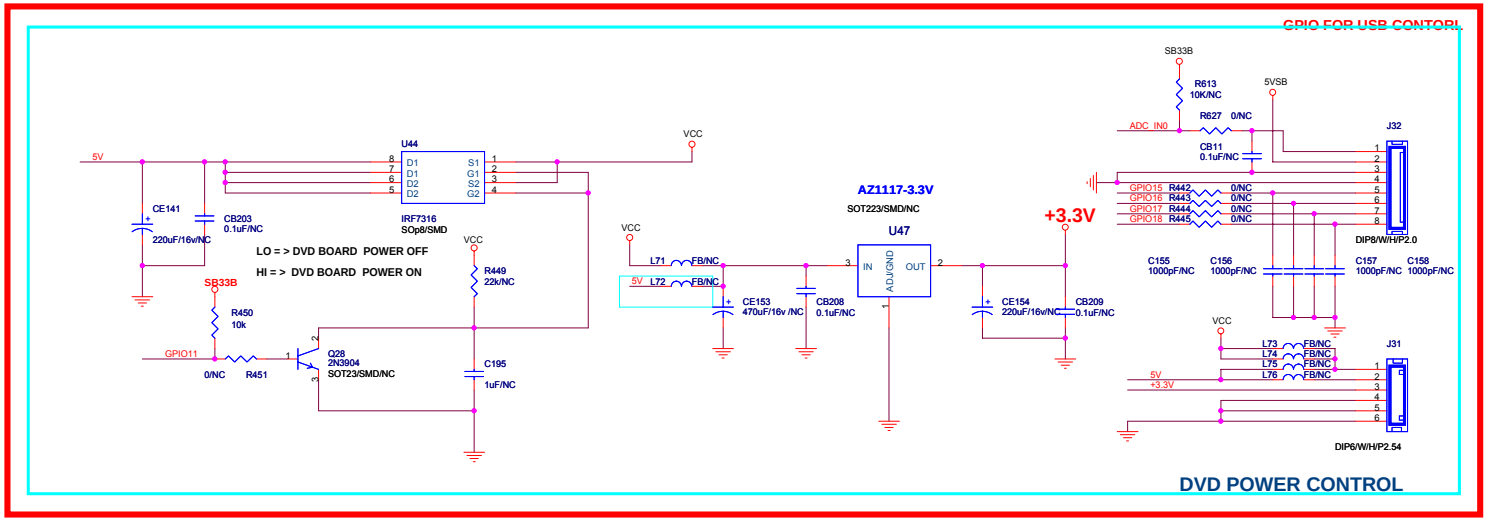
ADC_IN0	ADC_IN0	3
CCIR_V0	CCIR_V0	3
CCIR_V5	CCIR_V5	3
CCIR_V7	CCIR_V7	3
GPIO11	GPIO11	3
GPIO15	GPIO15	3
GPIO16	GPIO16	3
GPIO17	GPIO17	3
GPIO18	GPIO18	3
VFE_GND	VFE_GND	2,3,4,11
AADCVSS	AADCVSS	3,4,10
AV1_R	AV1_R	15
AV1_L	AV1_L	15
AV2_R	AV2_R	15
AV2_L	AV2_L	15
SY_R	SY_R	15
SY_L	SY_L	15
Y2_INB	Y2_INB	15
Y2_GNDB	Y2_GNDB	10,15
CB2_INB	CB2_INB	15
CB2_GNDB	CB2_GNDB	10,15
CR2_INB	CR2_INB	15
CR2_GNDB	CR2_GNDB	10,15
Y3_INB	Y3_INB	15
Y3_GNDB	Y3_GNDB	15
CB3_INB	CB3_INB	15
CB3_GNDB	CB3_GNDB	15
CR3_INB	CR3_INB	15
CR3_GNDB	CR3_GNDB	15
9V	9V	1,7,9,14

OUTPUT

AV_R	AV_R	9
AV_L	AV_L	9
YQ	YQ	10
CBQ	CBQ	10
CRQ	CRQ	10
YQ_GND	YQ_GND	10
CBQ_GND	CBQ_GND	10
CRQ_GND	CRQ_GND	10







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Title: DAUGHTER BOARD IN			
Size: C	Document Number: AKAI_MT8202_27US_LVDS_V0.0	<Designer>	Rev: 1
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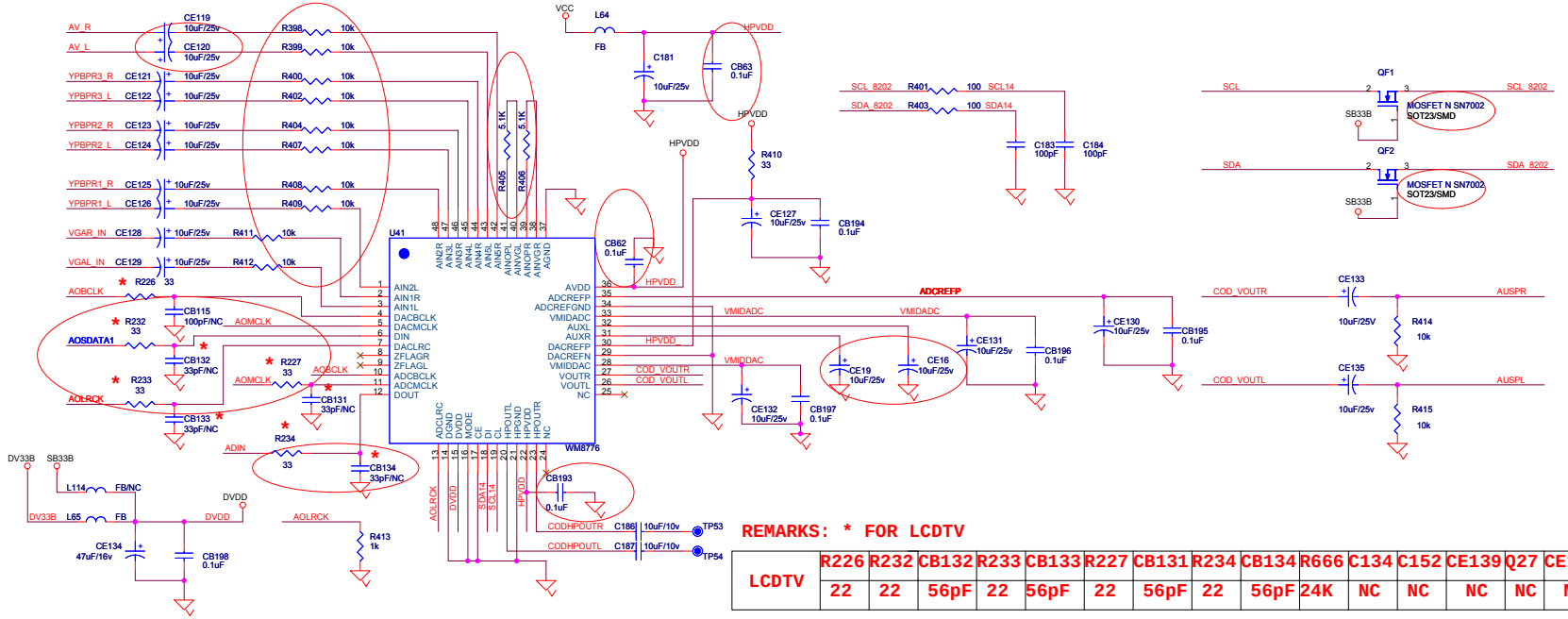
INPUT

GPIO7	GPIO7	3
SCL	SCL	1,14
SDA	SDA	1,14
SDA_8202	SDA_8202	3,6,12
SCL_8202	SCL_8202	3,6,12
AOSDATA1	AOSDATA1	3
AOMCLK	AOMCLK	3,16
AOBCLK	AOBCLK	3,16
AOLRCK	AOLRCK	3,16
ADIN	ADIN	3
AV_R	AV_R	8
AV_L	AV_L	8
YPBPR1_L	YPBPR1_L	15
YPBPR1_R	YPBPR1_R	15
YPBPR2_R	YPBPR2_R	15
YPBPR2_L	YPBPR2_L	15
YPBPR3_R	YPBPR3_R	15
YPBPR3_L	YPBPR3_L	15
VGAR_IN	VGAR_IN	11
VGAL_IN	VGAL_IN	11
TESTP2	TESTP2	3
AR	AR	3
AL	AL	3
MU	MU	16
A_MUTE	A_MUTE	17
9V	9V	1,7,14

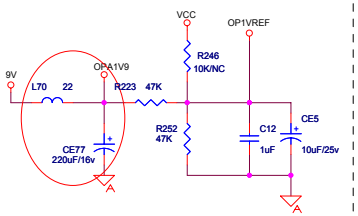
OUTPUT

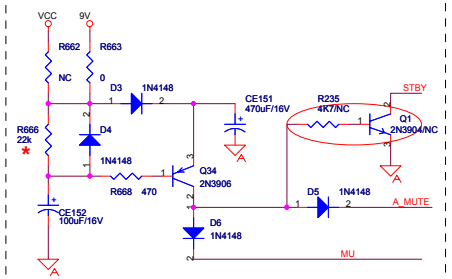
AUSPR	AUSPR	16
AUSPL	AUSPL	16
AVR_OUT	AVR_OUT	15
AVL_OUT	AVL_OUT	15
CVBS_OUT	CVBS_OUT	6,15

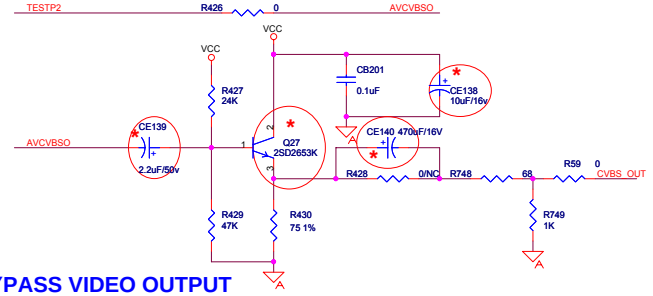


REMARKS: * FOR LCDTV

	R226	R232	CB132	R233	CB133	R227	CB131	R234	CB134	R666	C134	C152	CE139	Q27	CE140	CE138
LCDTV	22	22	56pF	22	56pF	22	56pF	22	56pF	24K	NC	NC	NC	NC	NC	NC

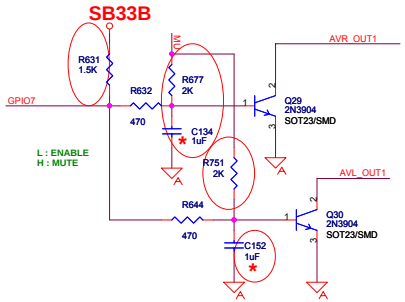




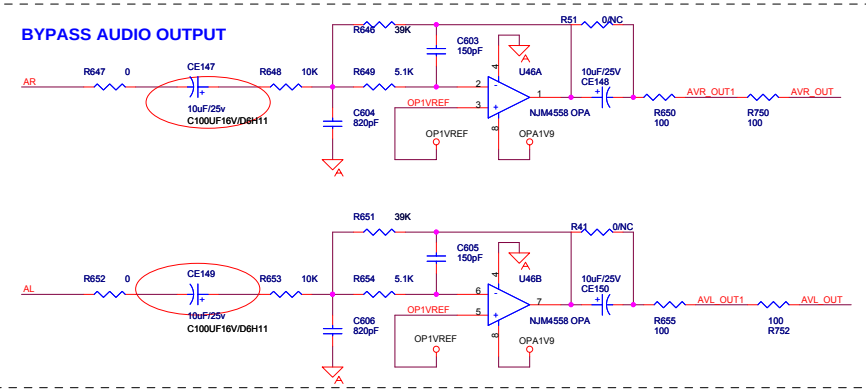


BYPASS VIDEO OUTPUT

AUDIO BYPASS MUTE



BYPASS AUDIO OUTPUT



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Title	M8776 & VIDEO BYPASS		
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CVBS0 CVBS0 3
CVBS1 CVBS1 3
CVBS2 CVBS2 3

SY0 SY0 3
SC0 SC0 3

SY1 SY1 3
SC1 SC1 3

Y0+ Y0+ 3
Y0- Y0- 3
PB0+ PB0+ 3
PB0- PB0- 3
PR0+ PR0+ 3
PR0- PR0- 3
SOY0 SOY0 3

Y1+ Y1+ 3
Y1- Y1- 3
PB1+ PB1+ 3
PB1- PB1- 3
PR1+ PR1+ 3
PR1- PR1- 3
SOY1 SOY1 3

MPX1 MPX1 3

MPX2 MPX2 3

TO MT8202

TV_GND TV_GND 14
CVBS_0 CVBS_0 14
SIF SIF 14
AF AF 14
CVBS_1 CVBS_1 15
CVBS1_GND CVBS1_GND 15
CVBS_2 CVBS_2 15
CVBS2_GND CVBS2_GND 15
SY_1 SY_1 15
SY_1_GND SY_1_GND 15
SC_1 SC_1 15
SC_1_GND SC_1_GND 15
SY_0 SY_0 15
SY_0_GND SY_0_GND 15
SC_0 SC_0 15
SC_0_GND SC_0_GND 15

SOY1 SOY1 3
SOY0 SOY0 3
Y1_INB Y1_INB 15
Y1_GNDB Y1_GNDB 8,15
CR1_INB CR1_INB 15
CR1_GNDB CR1_GNDB 8,15
CB1_INB CB1_INB 15
CB1_GNDB CB1_GNDB 8,15
CBQ CBQ 8
CRQ CRQ 8
YQ YQ 8
YQ_GND YQ_GND 8
CBQ_GND CBQ_GND 8
CRQ_GND CRQ_GND 8

FROM AV BOARD

AADCVSS AADCVSS 3,4

THIS PAGE NEARLY IC

CVBS_0 R197 0 C110 47nF CVBS0
C113 330pF TV_GND

CVBS_1 R200 0 C117 47nF CVBS1
C120 330pF CVBS1_GND

CVBS_2 R424 0 C188 47nF CVBS2
C189 330pF CVBS2_GND

SY_0 R198 0 C111 47nF SY0
C114 330pF SY_0_GND

SC_0 R201 0 C118 47nF SC0
C121 330pF SC_0_GND

SY_1 R205 0 C125 47nF SY1
C128 330pF SY_1_GND

SC_1 R209 0 C132 47nF SC1
C135 330pF SC_1_GND

R55 0 C112 4.7nF SOY0

YQ R199 68 C115 100nF Y0+
C116 15pF
YQ_GND R202 100 C119 100nF Y0-

CBQ R203 68 C122 100nF PB0+
C123 15pF
CBQ_GND R206 100 C126 100nF PB0-

CRQ R207 68 C129 100nF PR0+
C130 15pF
CRQ_GND R210 100 C133 100nF PR0-

R56 0 C136 4.7nF SOY1

Y1_INB R211 68 C137 100nF Y1+
C138 15pF
Y1_GNDB R213 100 C140 100nF Y1-

CB1_INB R214 68 C141 100nF PB1+
C142 15pF
CB1_GNDB R217 100 C145 100nF PB1-

CR1_INB R218 68 C146 100nF PR1+
C147 15pF
CR1_GNDB R219 100 C148 100nF PR1-

FROM Tuner

SIF R212 8.2K C139 10nF MPX1
C48 1.8pF AADCVSS

AF R215 39K R216 39K CE70 + 47uF/16V MPX2
C143 15pF C144 15pF AADCVSS

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Title: AUDIO / VIDEO IN CIRCUIT

Size	Document Number	Rev
C	AKAI_MT8202_27US_LVDS_V0.0	1

Designer: <Designer>
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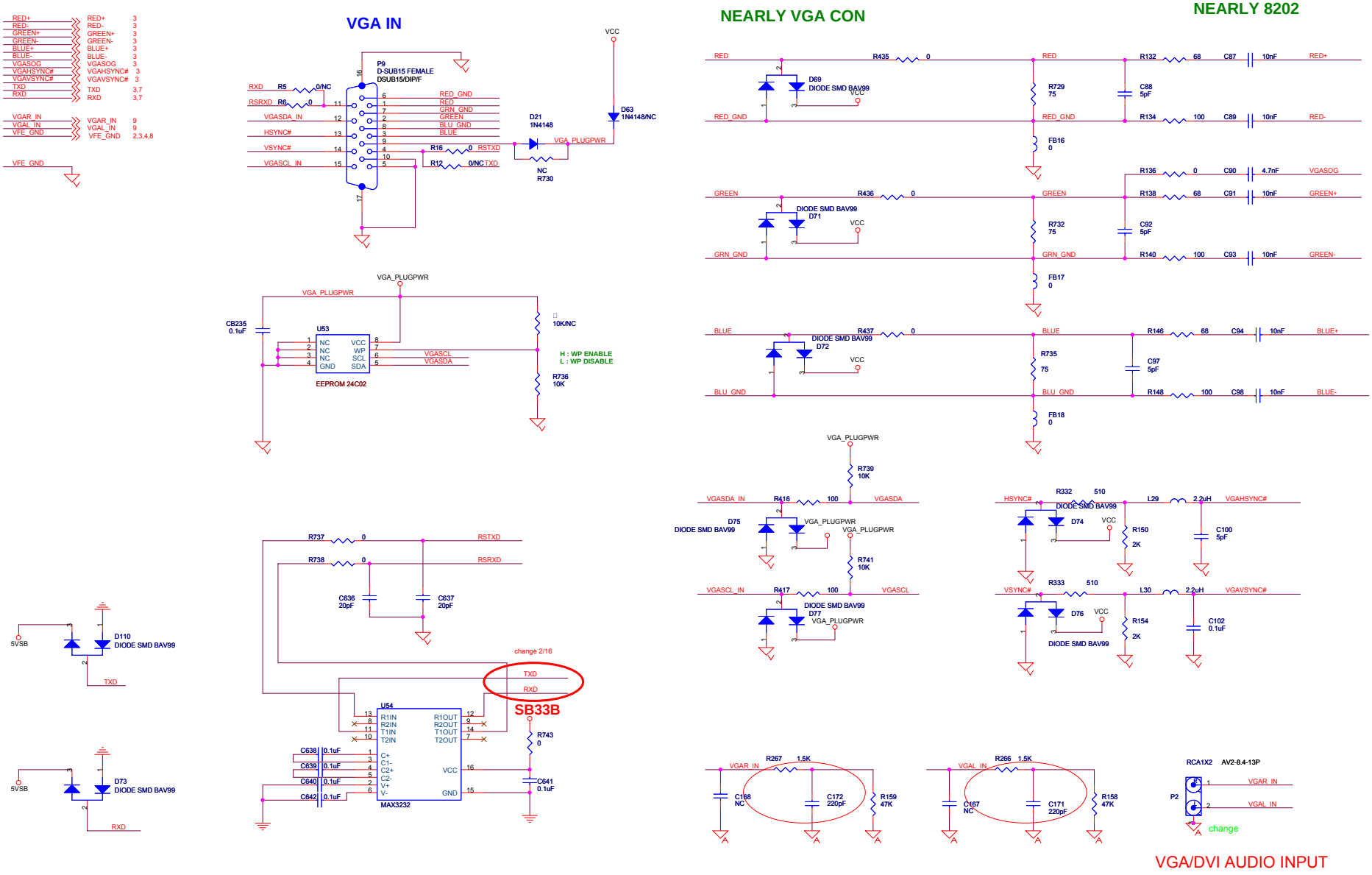

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Title: VGA IN & PC AUDIO IN			
Size: C	Document Number: AKAI_MT8202_27US_LVDS_V0.0	<Designer>	Rev: 1
		Checked: <Checker>	
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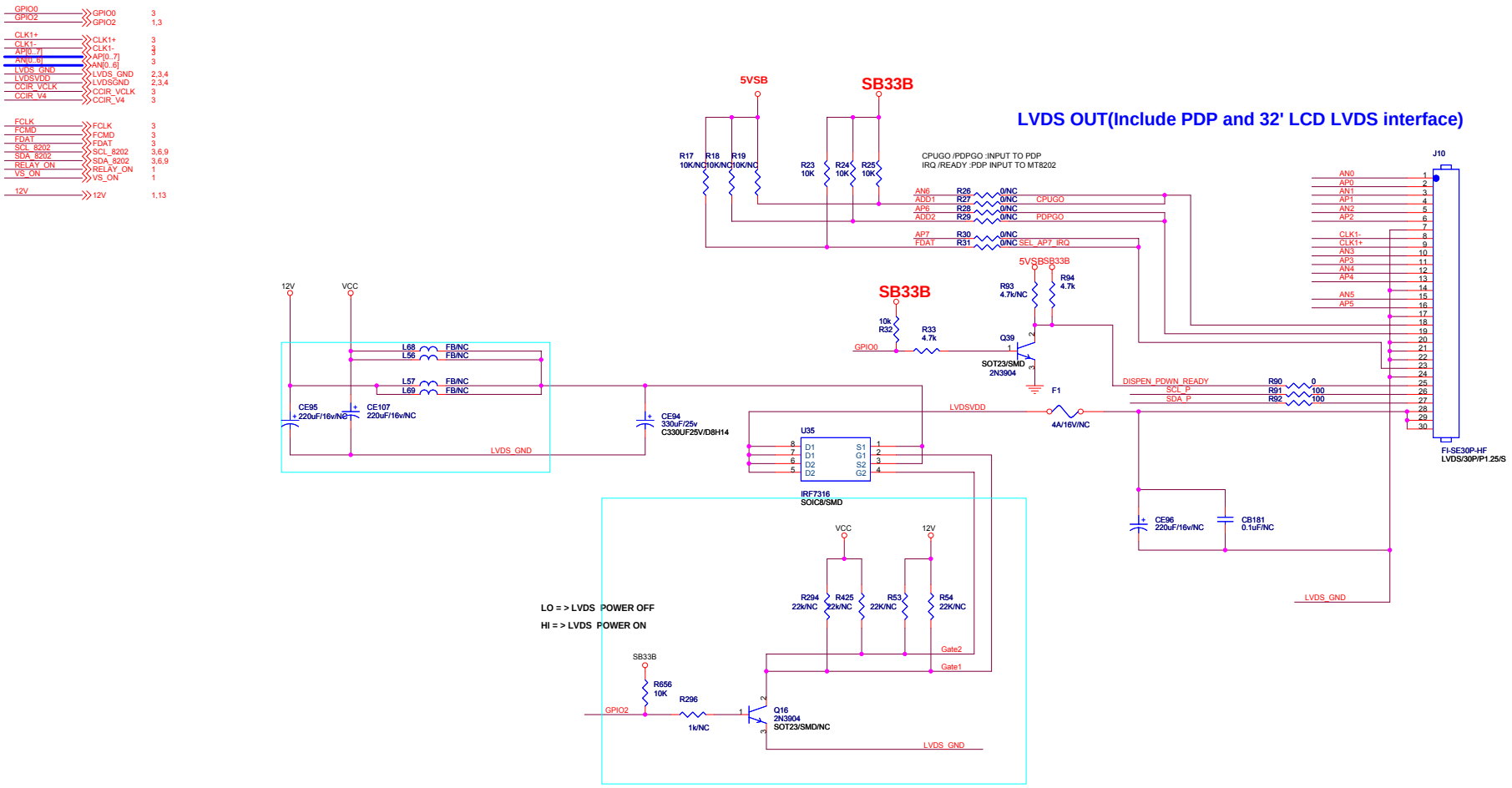

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Title	LVDS OUT		
Size C	Document Number AKAI_MT8202_27US_LVDS_V0.0	<Designer> Checked: <Checker>	Rev 1
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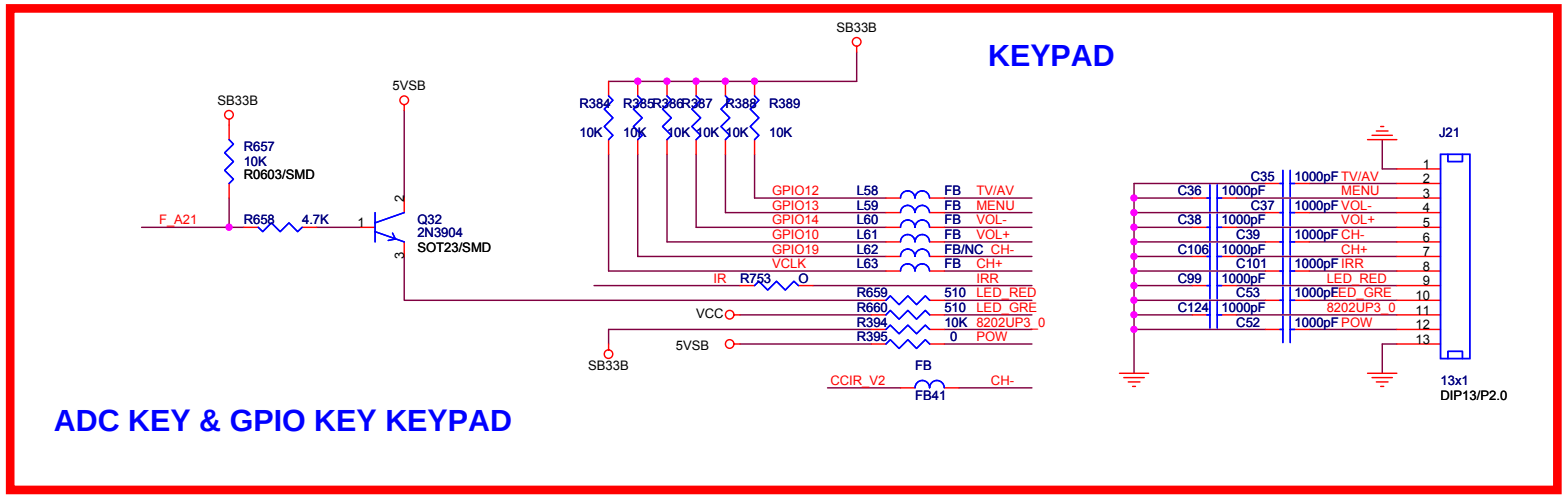
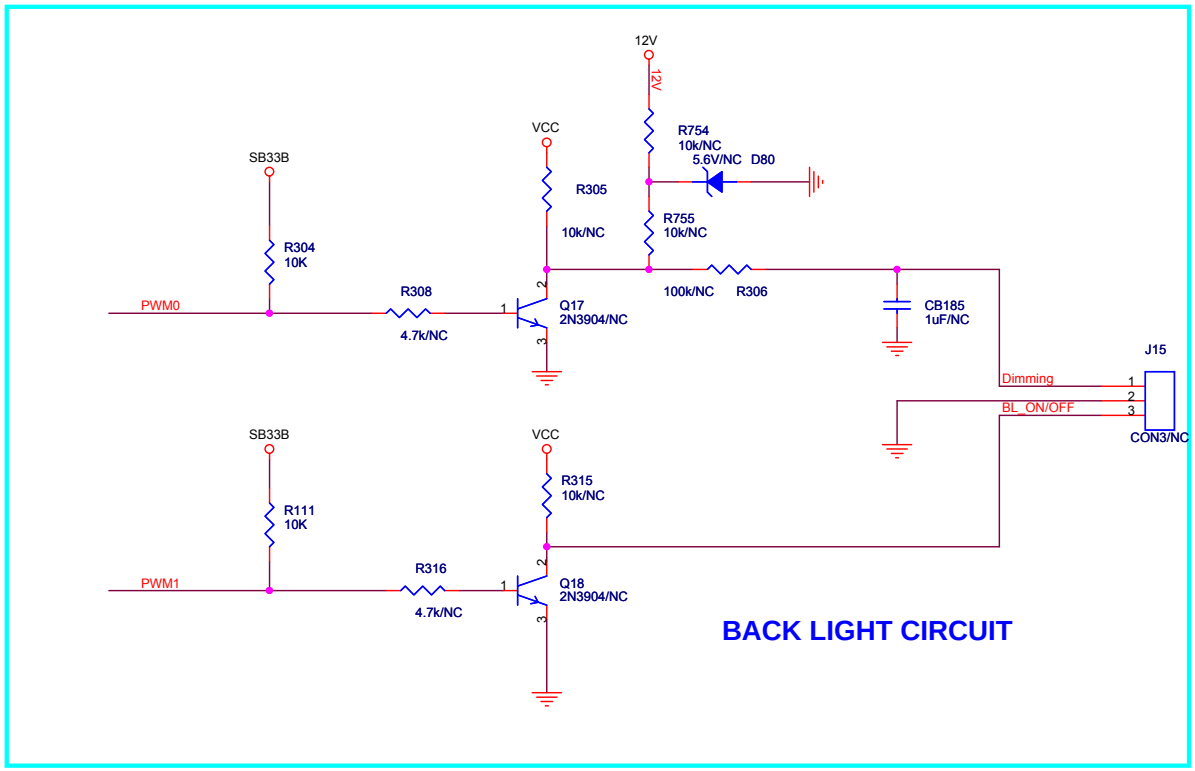
IR	IR	3,15
GPIO10	GPIO10	3
GPIO12	GPIO12	3
GPIO13	GPIO13	3
GPIO14	GPIO14	1,3
PWM0	PWM0	3
PWM1	PWM1	3
8202UP3_0	8202UP3_0	3
GPIO14	GPIO14	1,3
GPIO19	GPIO19	1,3
VCLK	VCLK	3
F_A21	F_A21	3
CCIR_V2	CCIR_V2	3
12V	12V	1,12





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Title: BACK LIGHT / KEYPAD			
Size: B	Document Number: AKAI_MT8202_27US_LVDS_V0.0	<Designer>	Rev: 1
		Checked: <Checker>	
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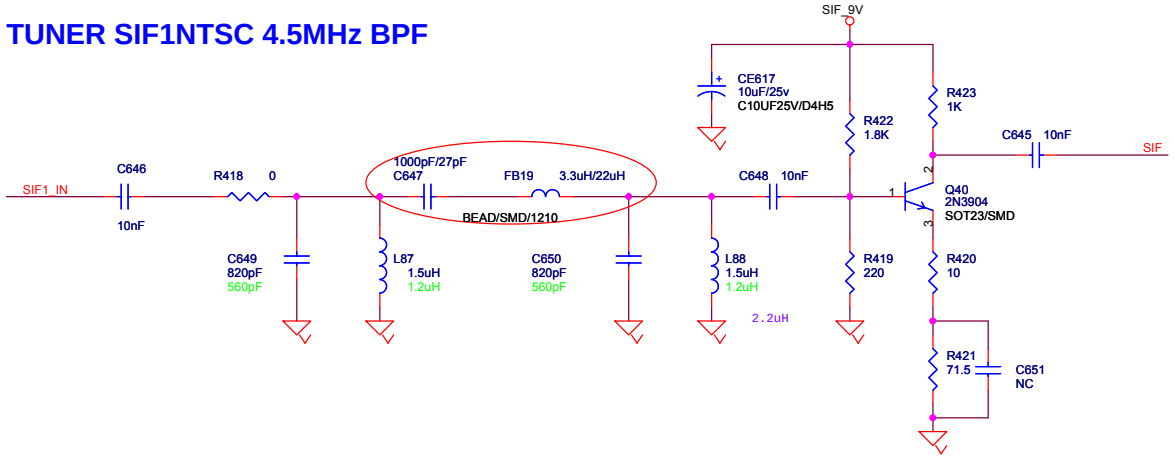
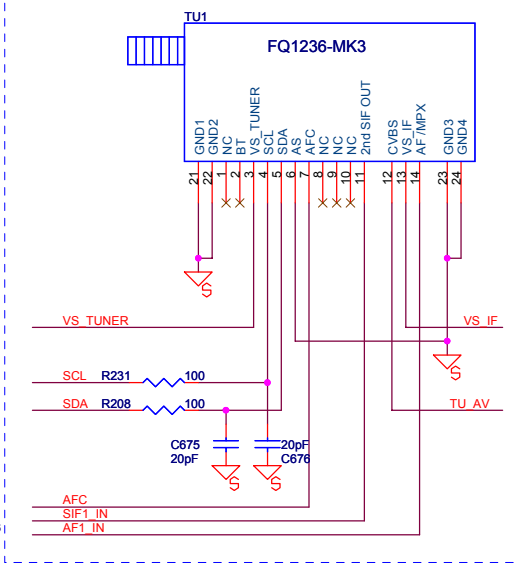
SCL 1,9
SDA 1,9
CVBS_0 10
TV_GND 10
AF 10
SIF 10
ADC_IN4 3
9V 1,7,9

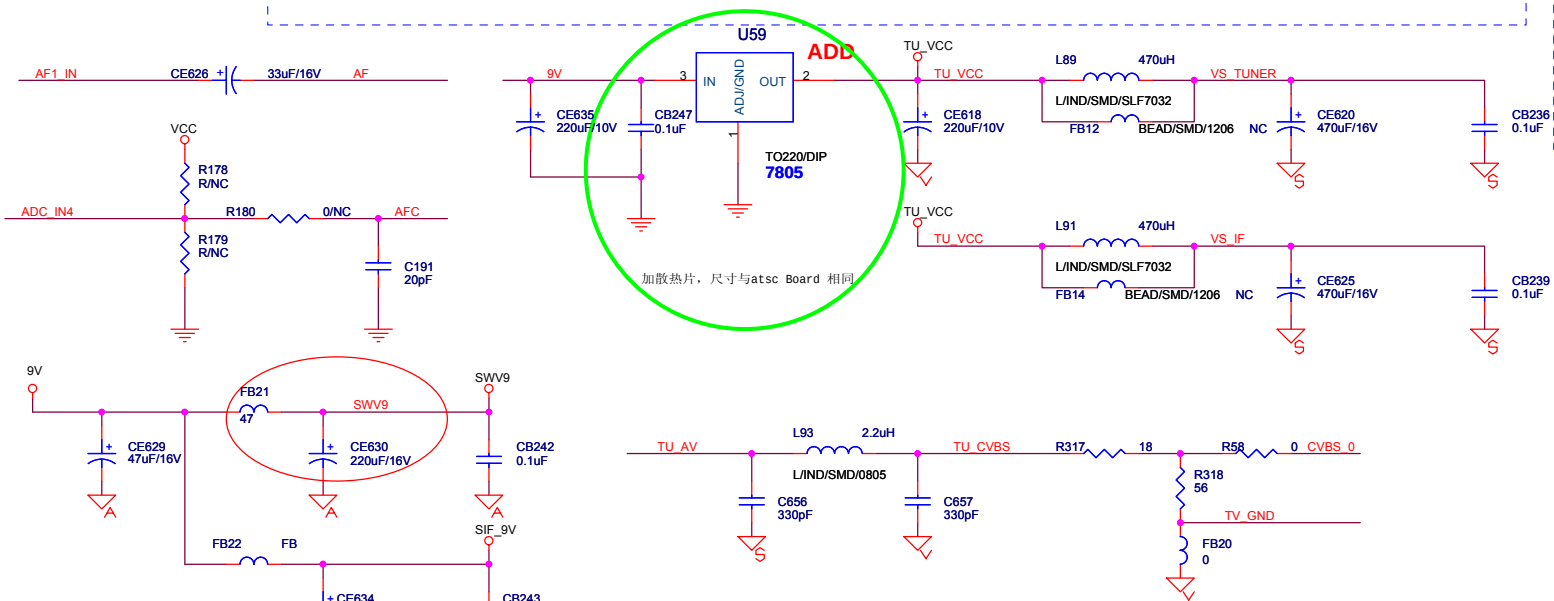
TUNER SIF1NTSC 4.5MHz BPF

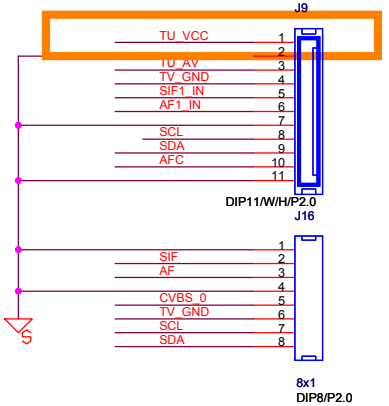


FQ1216 : PAL
FQ1236 : NTSC

ADDRESS
TUNER IF
C0 84







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Title	<Title>		
Size Custom	Document Number <Doc>		Rev <RevCode>
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Title	TUNER IN		
Size Custom	Document Number AKAI_MT8202_27US_LVDS_V0.0	<Designer> Checked: <Checker>	Rev 1
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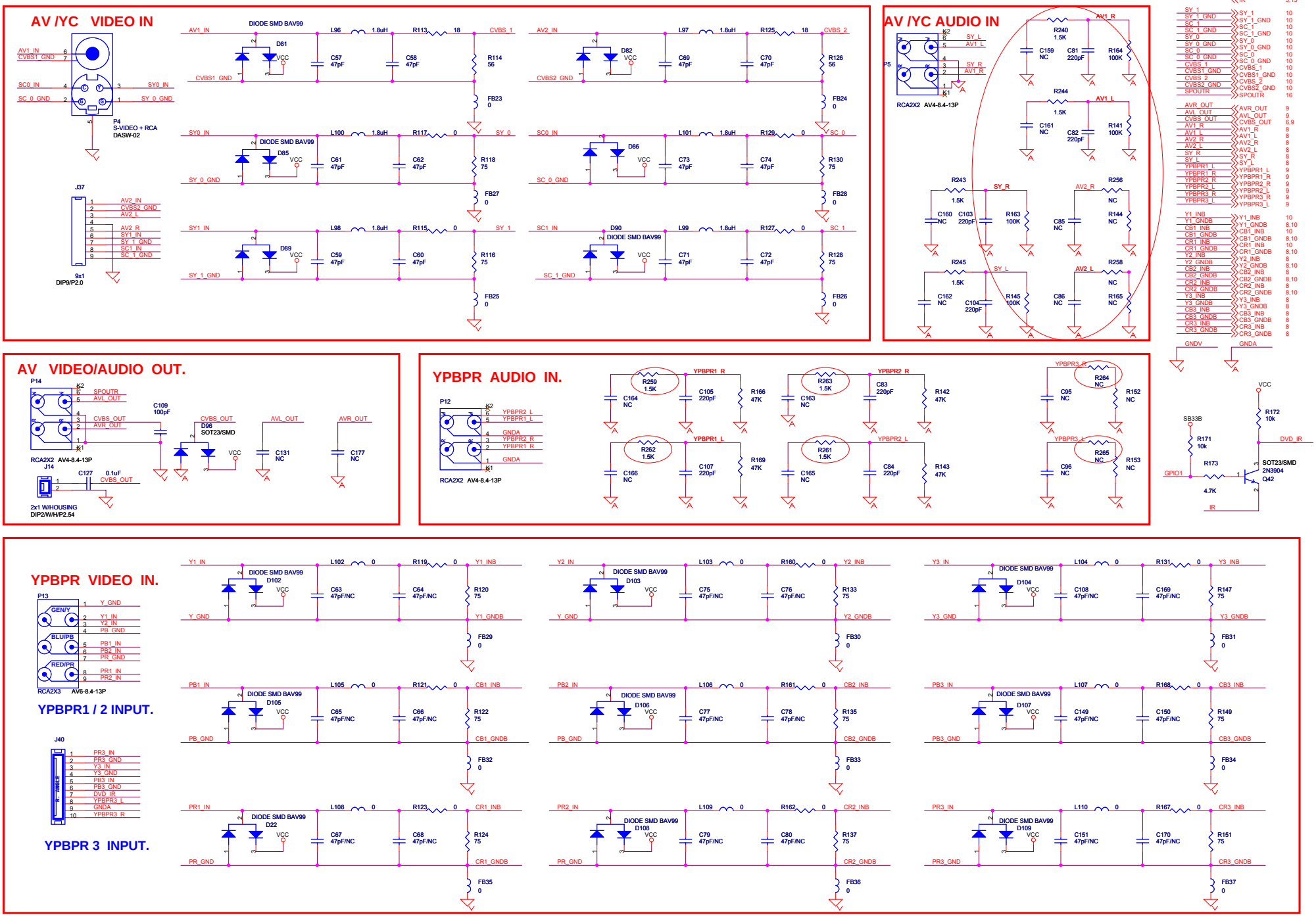
AV /YC VIDEO IN
AV1_IN
CVBS1_GND
SC0_IN
SC_0_GND
SY0_IN
SY_0_GND
P4
S-VIDEO + RCA
DASW-02
J37
9x1
DIP9/P2.0
DIODE SMD BAV99
D81
D82
D85
D86
D89
D90
L96
L97
L100
L101
L98
L99
1.8uH
R113
R125
R117
R129
R115
R127
18
0
CVBS_1
CVBS_2
SY_0
SC_0
SY_1
SC_1
R114
R126
R118
R130
R116
R128
56
75
C57
C69
C61
C73
C59
C71
C58
C70
C62
C74
C60
C72
47pF
FB23
FB24
FB27
FB28
FB25
FB26
VCC
AV /YC AUDIO IN
RCA2X2 AV4-8.4-13P
P5
SY_L
AV1_L
SY_R
AV1_R
R240
R244
R243
R256
R245
R258
1.5K
C159
C161
C160
C103
C162
C104
C81
C82
C85
C86
220pF
NC
R164
R141
R163
R144
R145
R165
100K
AV_OUT
AVL_OUT
CVBS_OUT
AVR_OUT
YPBPR1_L
YPBPR1_R
YPBPR2_R
YPBPR2_L
YPBPR3_R
YPBPR3_L
Y1_INB
Y1_GNDB
CB1_INB
CB1_GNDB
CR1_INB
CR1_GNDB
Y2_INB
Y2_GNDB
CB2_INB
CB2_GNDB
CR2_INB
CR2_GNDB
Y3_INB
Y3_GNDB
CB3_INB
CB3_GNDB
CR3_INB
CR3_GNDB
GNDV
GNDA
AV VIDEO/AUDIO OUT.
P14
SPOUTR
AVL_OUT
CVBS_OUT
AVR_OUT
C109
100pF
D96
SOT23/SMD
C131
C177
RCA2X2 AV4-8.4-13P
J14
C127
0.1uF
2x1 W/HOUSING
DIP2/W/H/P2.54
YPBPR AUDIO IN.
P12
YPBPR2_L
YPBPR1_L
GNDA
YPBPR2_R
YPBPR1_R
RCA2X2 AV4-8.4-13P
R259
R262
R263
R261
R264
R265
C164
C166
C163
C165
C105
C107
C83
C84
C95
C96
R166
R169
R142
R143
R152
R153
47K
SB33B
R171
10k
R172
DVD_IR
R173
4.7K
SOT23/SMD
2N3904
Q42
GPIO1
IR
YPBPR VIDEO IN.
P13
GEN/Y
BLU/PB
RED/PR
Y_GND
Y1_IN
Y2_IN
PB_GND
PB1_IN
PB2_IN
PR_GND
PR1_IN
PR2_IN
RCA2X3 AV6-8.4-13P
YPBPR1 / 2 INPUT.
J40
YPBPR 3 INPUT.
PR3_IN
PR3_GND
Y3_IN
Y3_GND
PB3_IN
PB3_GND
DVD_IR
YPBPR3_L
GNDA
YPBPR3_R
Y1_GNDB
Y2_GNDB
CB1_GNDB
CB2_GNDB
CR1_GNDB
CR2_GNDB
D102
D103
D105
D106
D108
D104
D107
D109
D22
C63
C75
C65
C77
C67
C79
C64
C76
C66
C78
C68
C80
C108
C149
C151
C169
C150
C170
47pF/NC
R119
R160
R121
R161
R123
R162
R131
R168
R167
R120
R133
R122
R135
R124
R137
R147
R149
R151
75
FB29
FB30
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FB37
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AV IN
Size
C
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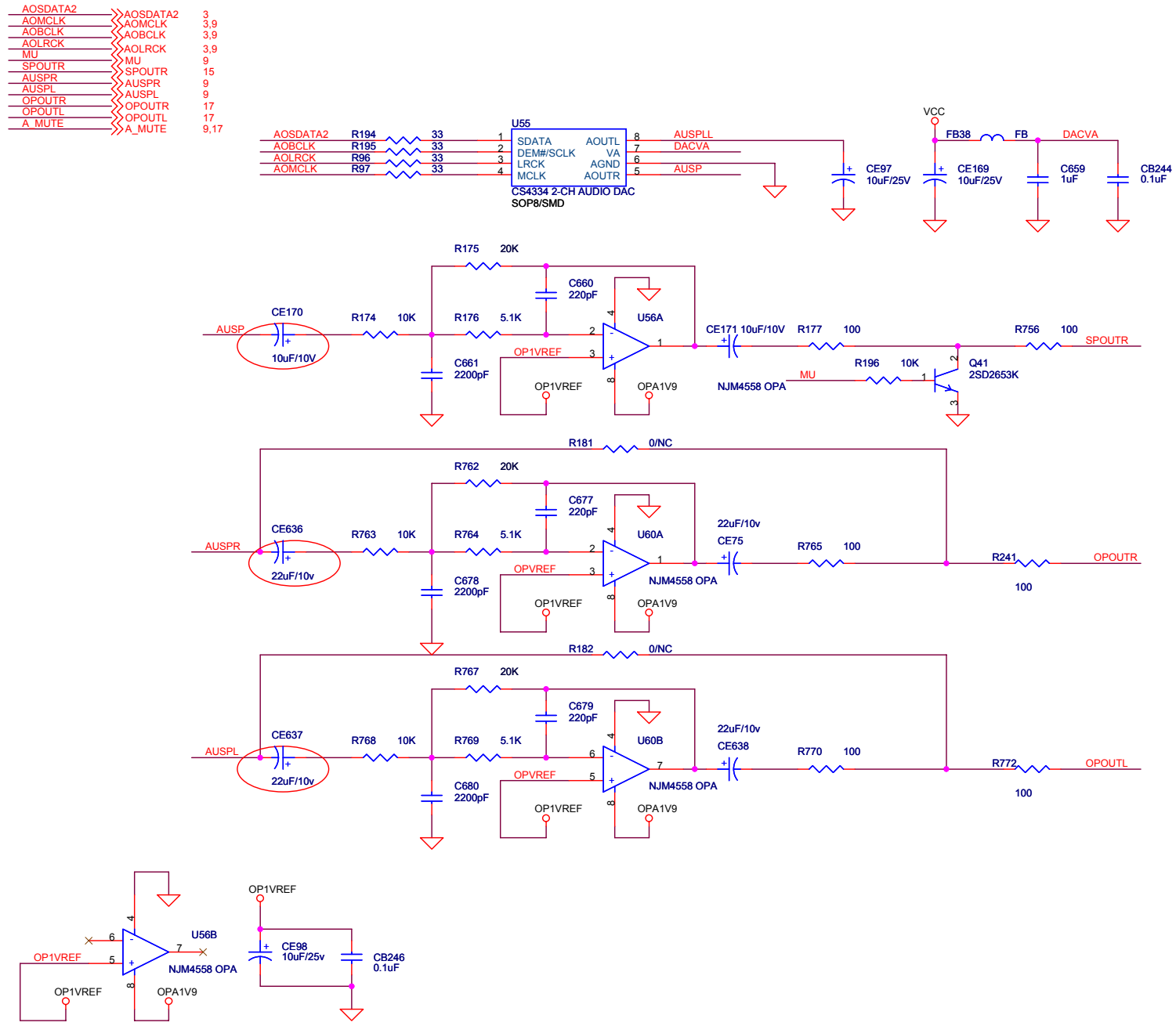

GPIO DECRIPTION

UP3_4 : SW SCL
UP3_5 : SW SDA
ERO0/UP3_0 :KEYPAD POWER
ERO1/UP3_1 : MAIN POWER SWITCH
VCLK : KEPAD CH+
GPIO19 : KEPAD CH-
DE/GPIO : DVD IR
CCIR_CLK : PDP USE
CCIR_V4 : PDP USE
GPIO0 : PDP USE
GPIO1 : NO USE
GPIO2 : LVDS POWER SW
GPIO3 : DTV POWER CONTROL
GPIO4 : EEPROM WRITE PROTECT
GPIO5/TXD : 2nd UART FOR MT5351
GPIO6/RXD : 2nd UART FOR MT5351
GPIO7 : AUDIO BYPASS MUTE CONTROL
GPIO8 : SPEAKER SWITCH
GPIO9 : AUDIO MUTE
GPIO10 : Indicates active video at HDMI port
GPIO11 : DVD POWER CONTROL
GPIO12 : AV SWITCH
GPIO13 : HDMI Hot Plug Detect
GPIO14 : NO USE
GPIO[15..18] : FOR DVD CONTROL
GPIO/PWM0 : DIMMING
GPIO/PWM1 : BACKLIGHT ON/OFF
OUT_27Mhz/GPIO : HDMI CRYSTAL
SDA1 : TO MT5351 I/F REQUEST
SCL1 : TO MT5351 I/F READY
F_A21 : KEYPAD(LED RED)
ADCIN0 : KEYPAD
ADCIN3:PDP 5VD DETECT
ADCIN4:FOR TUNER AFC

CCIR_V[0-3] : KEYPAD
CCIR_V5 : AUDIO SWITCH
CCIR_V6 : RESET DTV
CCIR_V7 : YPBPR VIDEO SWITCH

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Title: SUB WOOFER			
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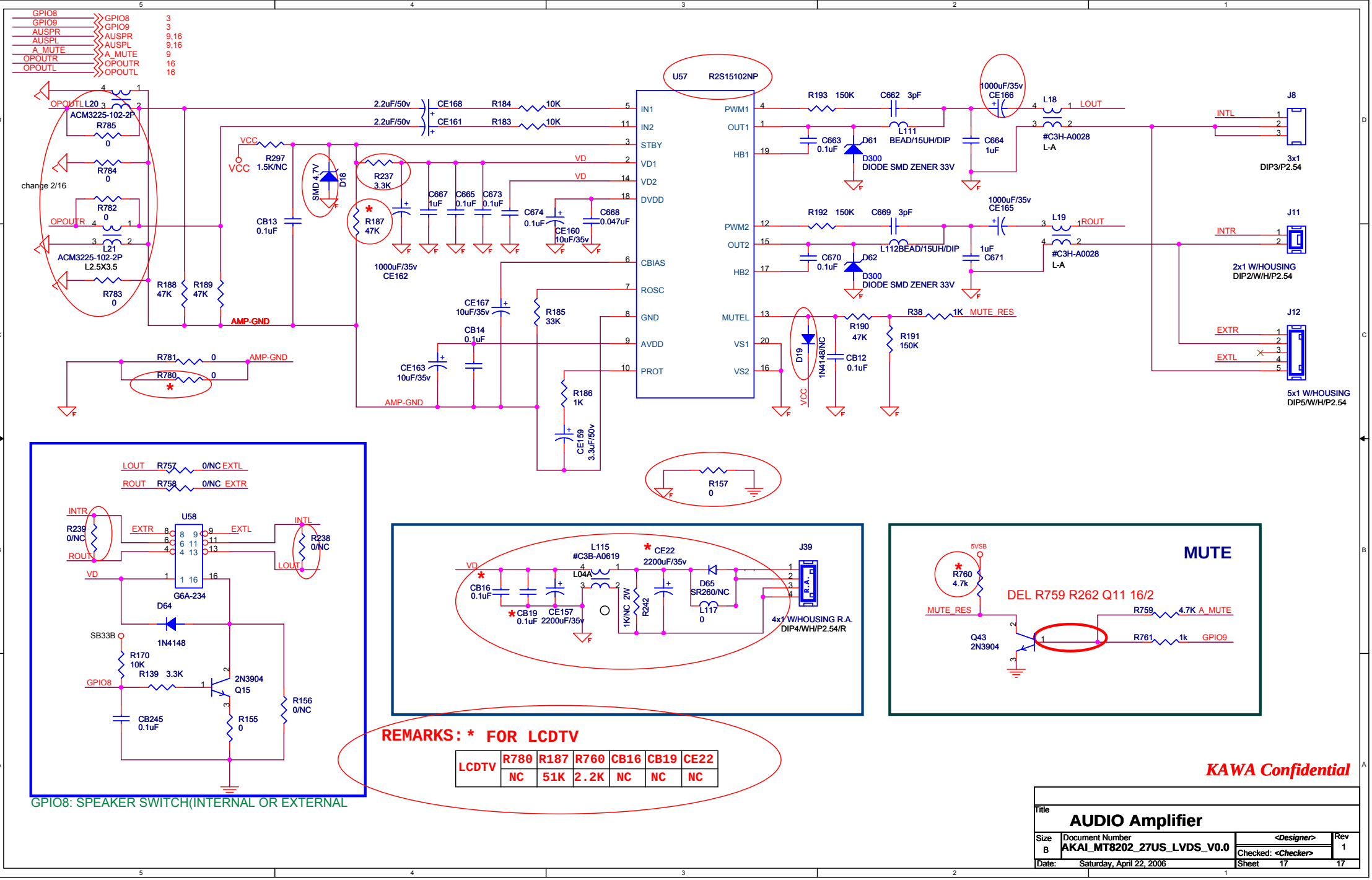
GPIO8 GPIO8 3
GPIO9 GPIO9 3
AUSPR AUSPR 9,16
AUSPL AUSPL 9,16
A_MUTE A_MUTE 9
OPOUTR OPOUTR 16
OPOUTL OPOUTL 16
U57 R2S15102NP
IN1
IN2
STBY
VD1
VD2
DVDD
CBIAS
ROSC
GND
AVDD
PROT
PWM1
OUT1
HB1
PWM2
OUT2
HB2
MUTEL
VS1
VS2
ACM3225-102-2P
R785 0
R784 0
R782 0
ACM3225-102-2P
L2.5X3.5
R783 0
change 2/16
R188 47K
R189 47K
AMP-GND
R781 0
R780 0
VCC
R297 1.5K/NC
SMD 4.7V
D18
CB13 0.1uF
2.2uF/50v
CE168
CE161
R184 10K
R183 10K
R237 3.3K
R187 47K
1000uF/35v CE162
C667 1uF
C665 0.1uF
C673 0.1uF
C674 0.1uF
CE160 10uF/35v
C668 0.047uF
CE167 10uF/35v
CB14 0.1uF
CE163 10uF/35v
R185 33K
R186 1K
CE159 3.3uF/50v
R193 150K
C662 3pF
C663 0.1uF
D61
L111 BEAD/15UH/DIP
D300 DIODE SMD ZENER 33V
1000uF/35v CE166
C664 1uF
L18
LOUT
#C3H-A0028 L-A
R192 150K
C669 3pF
C670 0.1uF
D62
L112BEAD/15UH/DIP
D300 DIODE SMD ZENER 33V
1000uF/35v CE165
1uF C671
L19
ROUT
#C3H-A0028 L-A
R38 1K MUTE_RES
R190 47K
R191 150K
D19 1N4148/NC
CB12 0.1uF
J8
INTL
3x1 DIP3/P2.54
J11
INTR
2x1 W/HOUSING DIP2/W/H/P2.54
J12
EXTR
EXTL
5x1 W/HOUSING DIP5/W/H/P2.54
R157 0
LOUT R757 0/NC EXTL
ROUT R758 0/NC EXTR
INTR
R239 0/NC
ROUT
EXTR
U58
G6A-234
EXTL
INTL
R238 0/NC
LOUT
VD
D64
1N4148
SB33B
R170 10K
R139 3.3K
GPIO8
2N3904 Q15
R156 0/NC
CB245 0.1uF
R155 0
GPIO8: SPEAKER SWITCH(INTERNAL OR EXTERNAL
L115 #C3B-A0619
L04A
CE22 2200uF/35v
CB16 0.1uF
CB19 0.1uF
CE157 2200uF/35v
1K/NC 2W
R242
D65 SR260/NC
L117 0
J39
R.A.
4x1 W/HOUSING R.A. DIP4/WH/P2.54/R
MUTE
5VSB
R760 4.7k
MUTE_RES
DEL R759 R262 Q11 16/2
R759 4.7K A_MUTE
Q43 2N3904
R761 1k GPIO9
REMARKS: * FOR LCDTV
LCDTV | R780 | R187 | R760 | CB16 | CB19 | CE22
NC | 51K | 2.2K | NC | NC | NC
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Title
AUDIO Amplifier
Size B
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<Designer>
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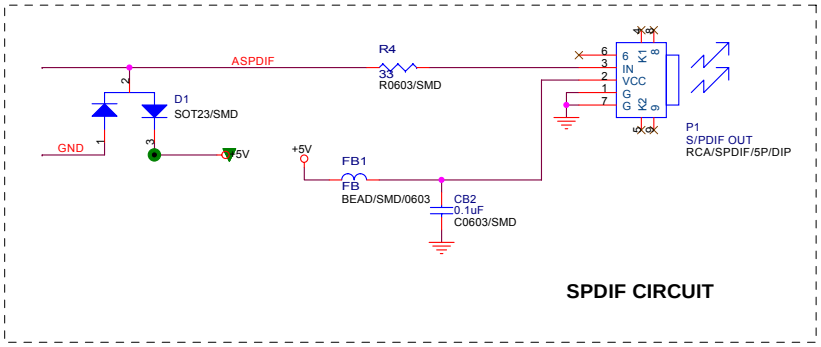
MT5111 / MT5351 REFERENCE DESIGN - 4 LAYERS

Rev	History	P#	DATE
RA-V1	INITIAL VERSION		2005/06/15
RA-V2	ADDED AUDIO SWITCH / REFINE POWER CIRCUIT		2005/07/14

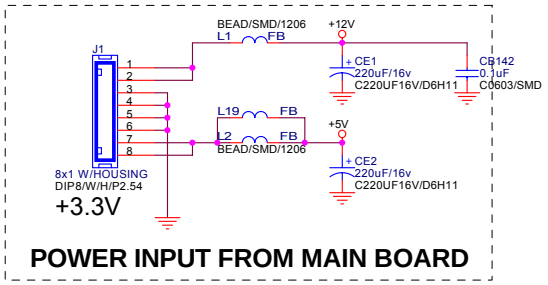
01. INDEX AND INTERFACE
02. POWER
03. TUNER
04. MT5111 ASIC
05. MT5351 ASIC
06. MT5351 PERIPHERAL
07. DDR MEMORY
08. NOR FLASH / JTAG / UART

NS : NON-STUFF

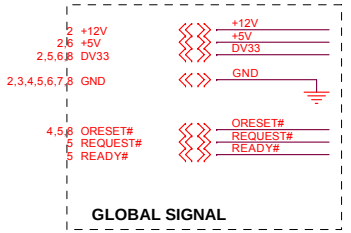
NAME	TYPE	DEVICE
+12V	POWER +12V	POWER SUPPLY
+5V	POWER +5V	POWER SUPPLY
+5V_tuner	POWER +5V	TUNER POWER
DV33_DM	POWER +3V3	MT5111 POWER
DV18	POWER +1V8	MT5111 POWER
DV33	POWER +3V3	MT5351 POWER
AV33	POWER +3V3	MT5351 ANALOG POWER
DV25	POWER +2V5	MT5351 DDR POWER
DV12	POWER +1V2	MT5351 POWER
GND	GROUND	GROUND

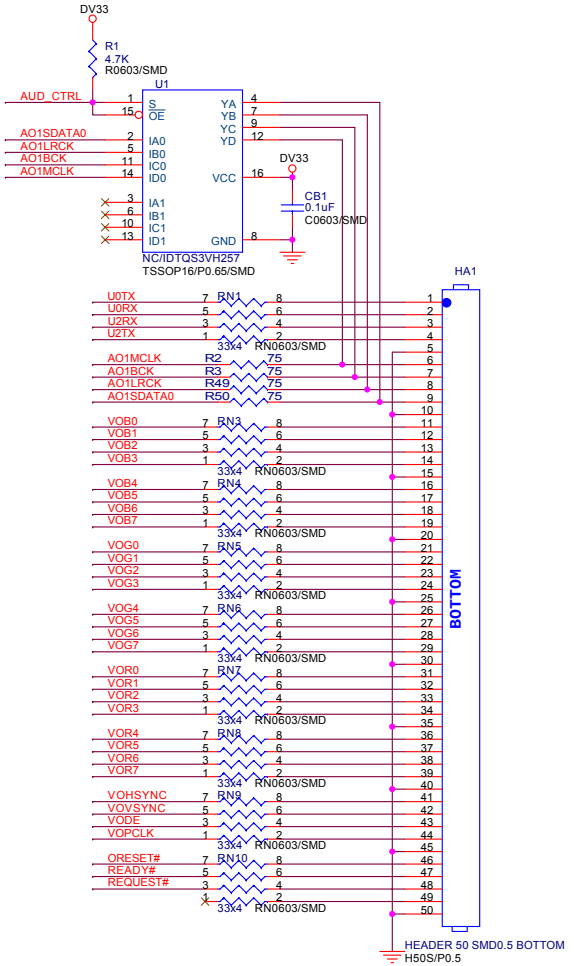


SPDIF CIRCUIT

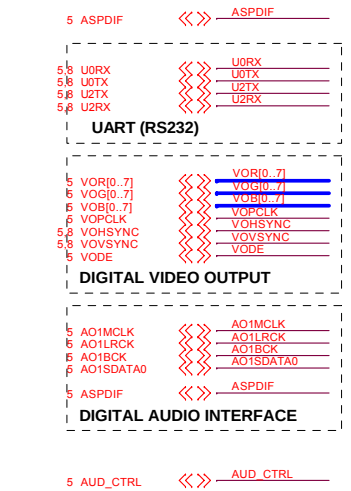


POWER INPUT FROM MAIN BOARD





DIGITAL OUTPUT



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Title: INDEX			
Size: Custom	Document Number: MT5351RA-V2	TwinSon Chan	Rev: 1
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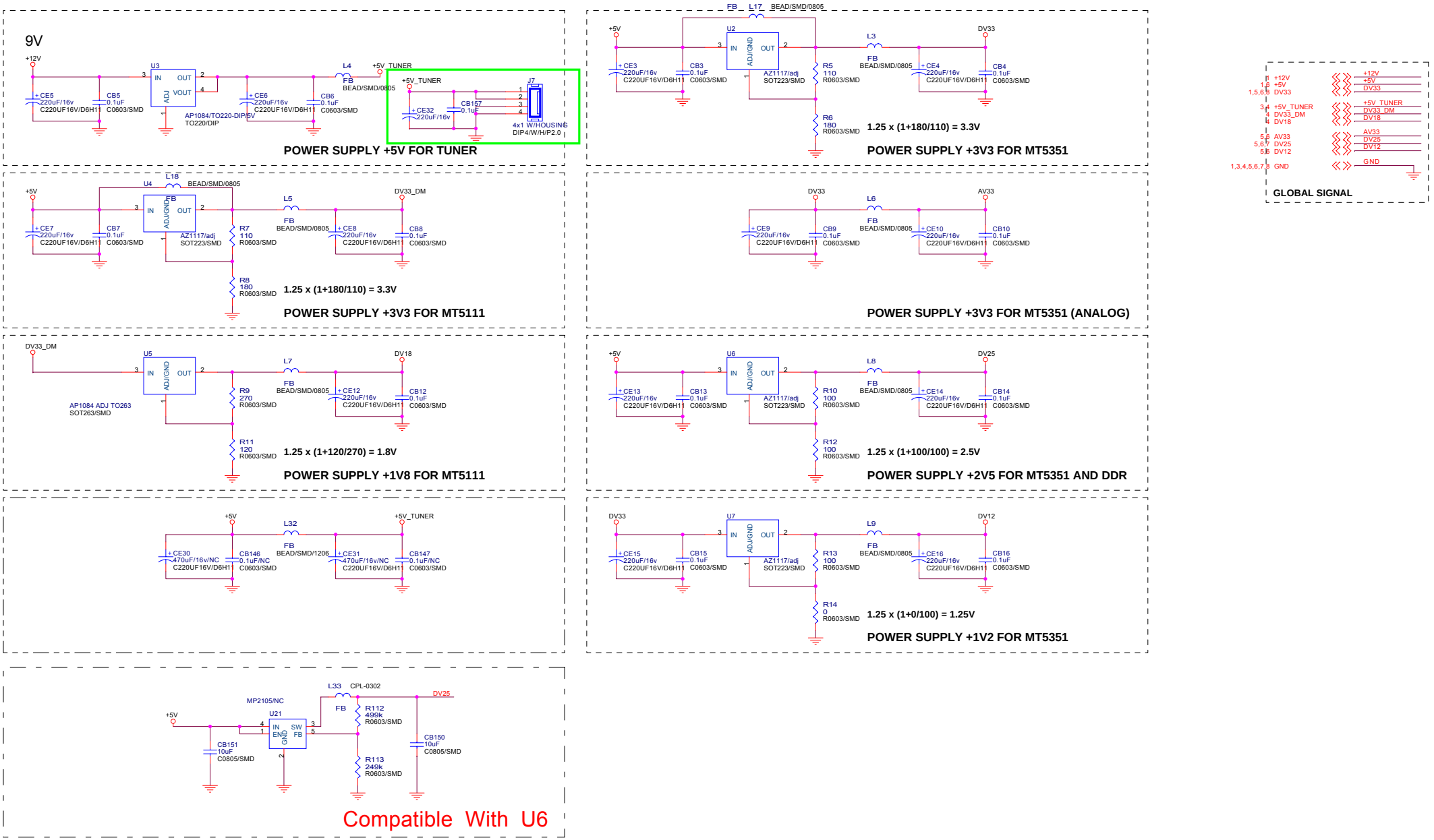

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Title: POWER		
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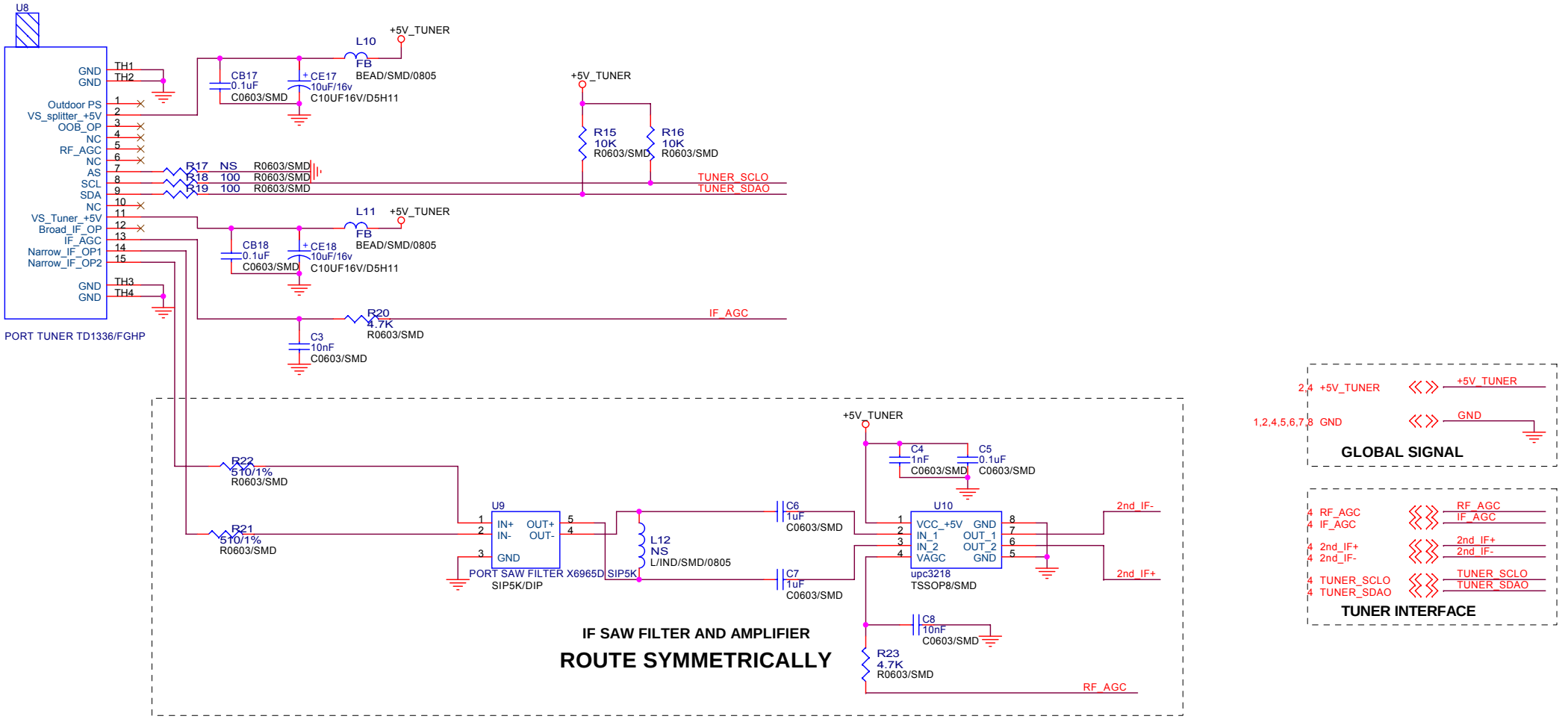

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Title: TUNER			
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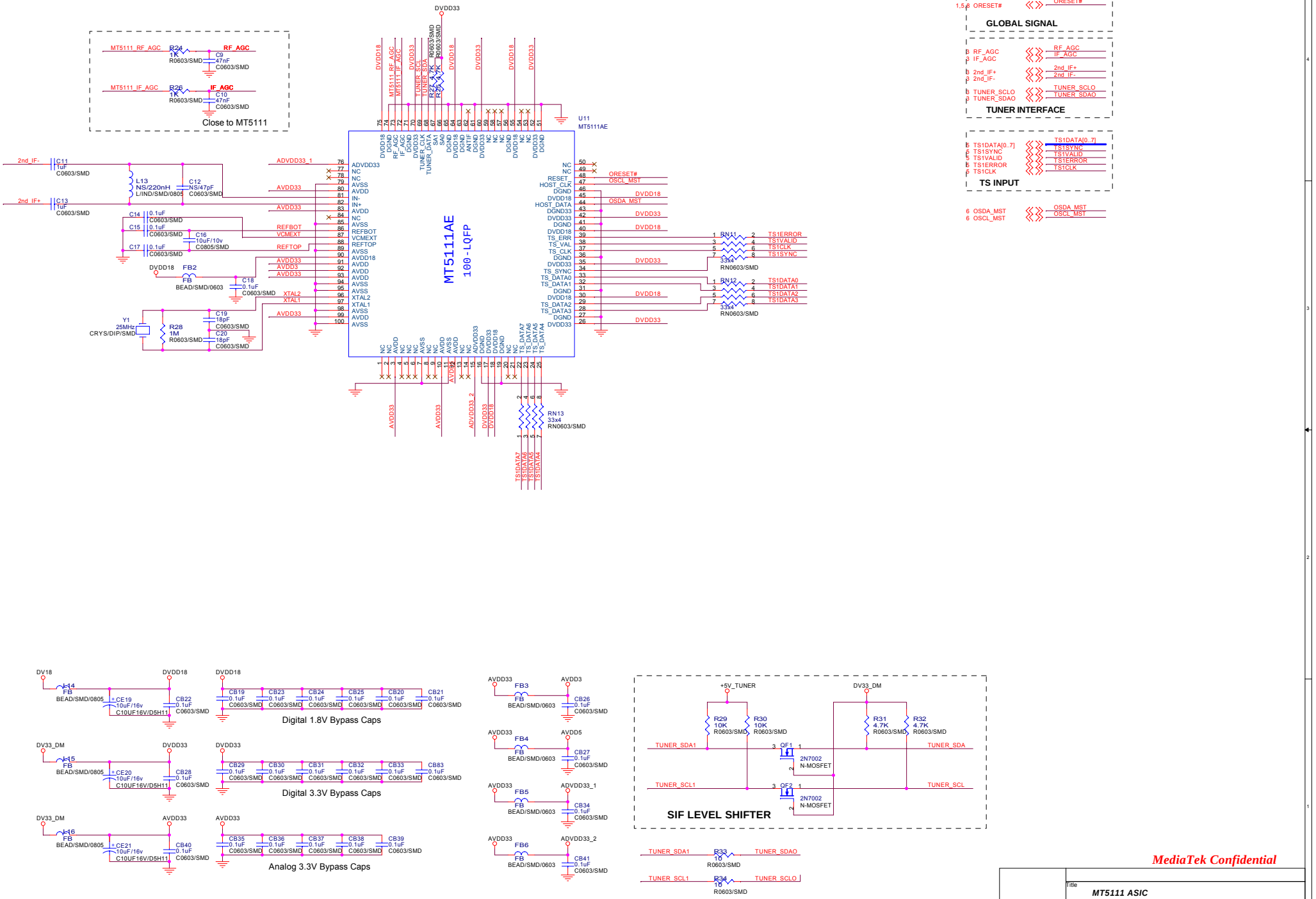

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Title: MT5111 ASIC			
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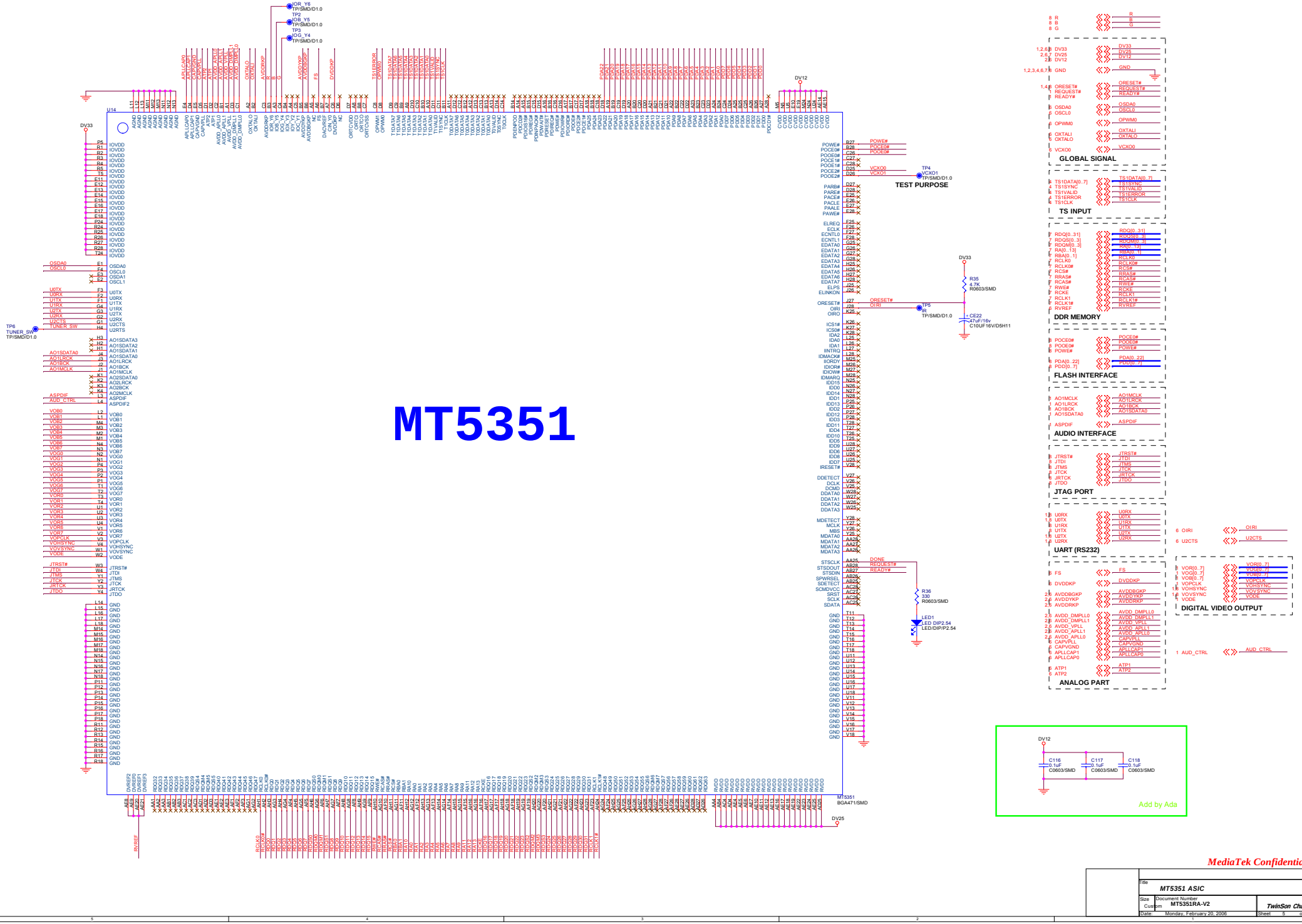
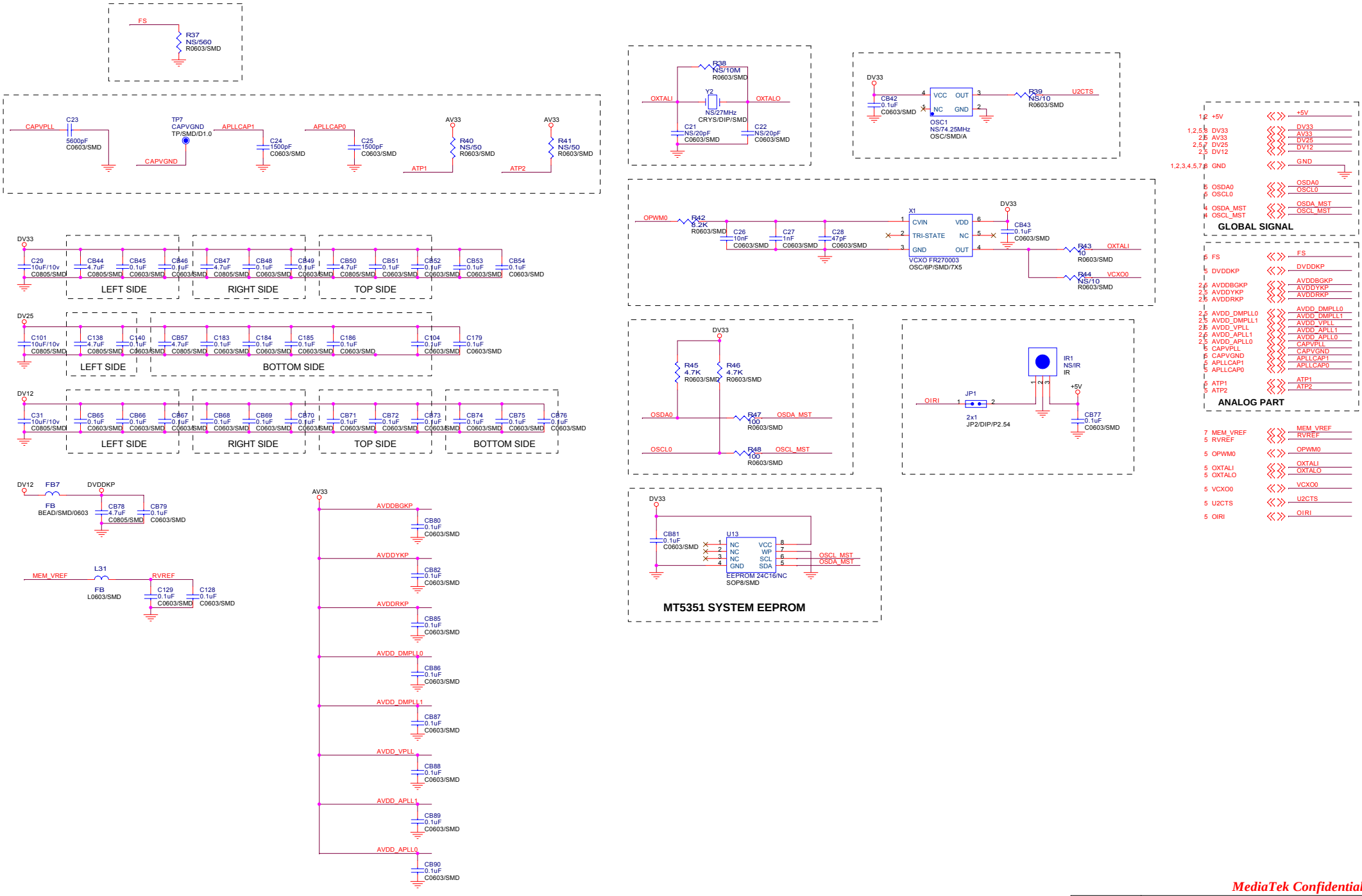

MT5351
TEST PURPOSE
GLOBAL SIGNAL
TS INPUT
DDR MEMORY
FLASH INTERFACE
AUDIO INTERFACE
JTAG PORT
UART (RS232)
DIGITAL VIDEO OUTPUT
ANALOG PART
MT5351
BGA471/SMD
MediaTek Confidential
MT5351 ASIC
MT5351RA-V2
TwinSon Chan
Monday, February 20, 2006



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Title: MT5351 PERIPHERAL			
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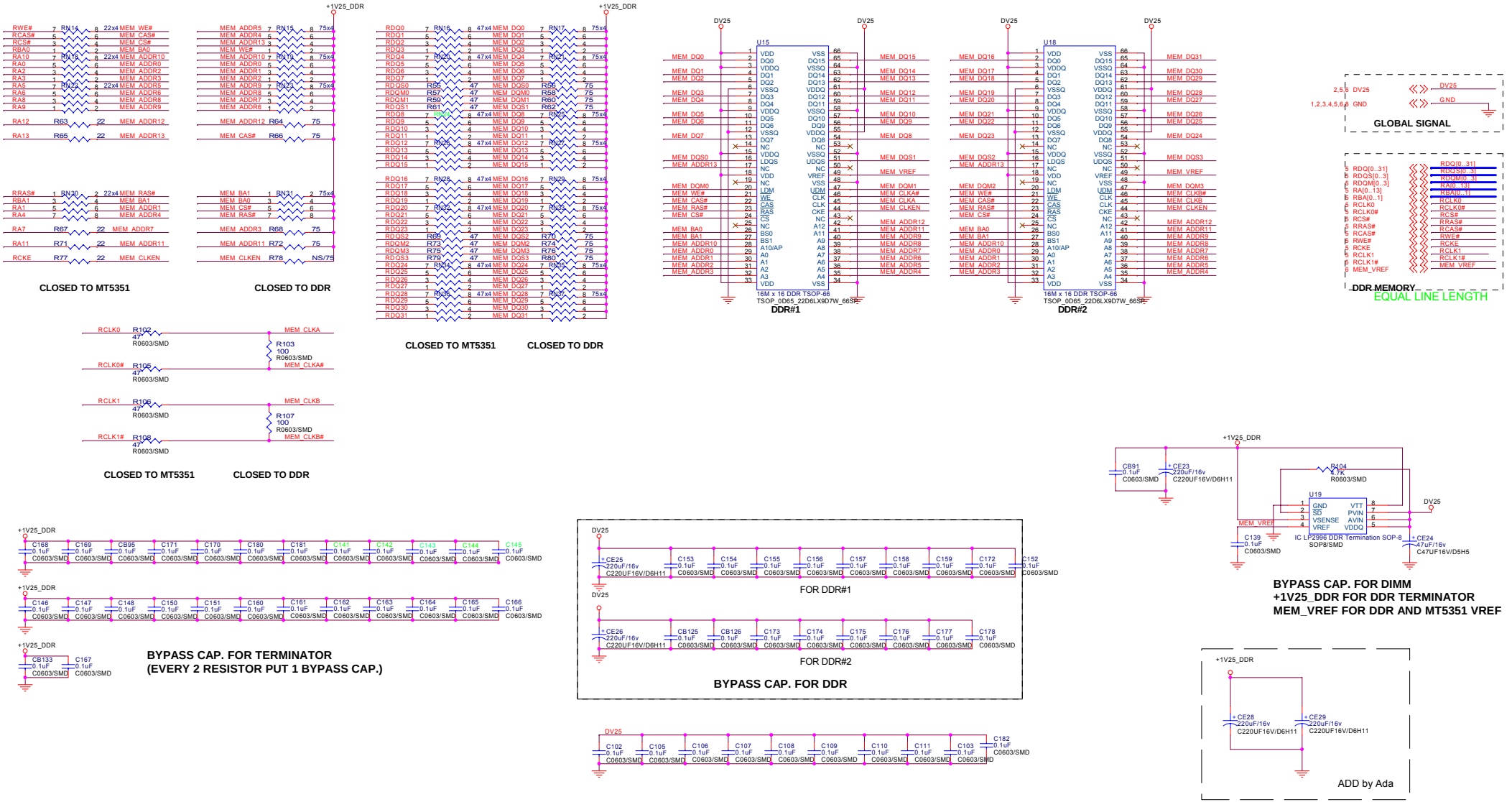

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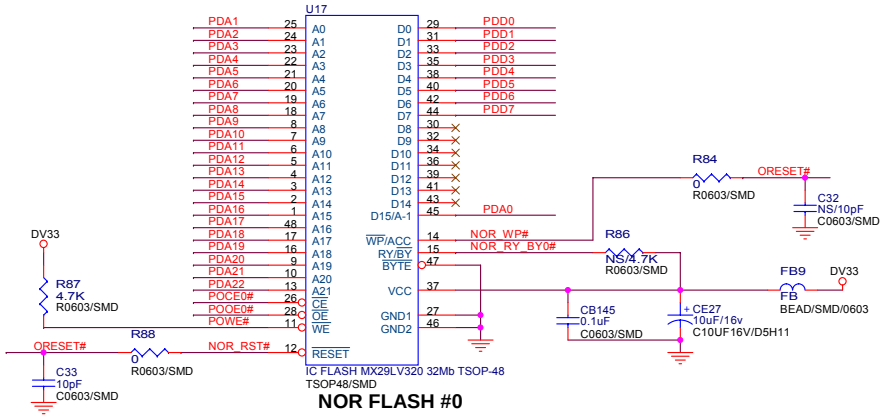
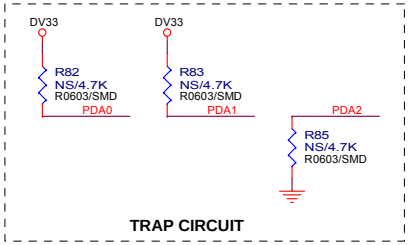
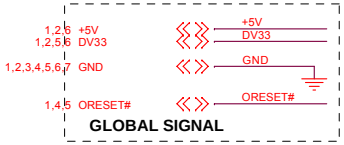
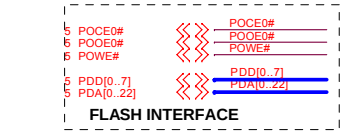
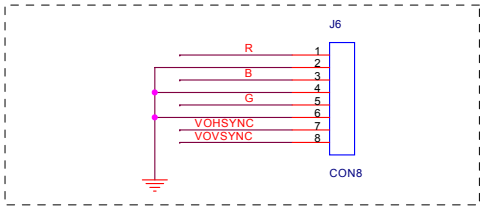
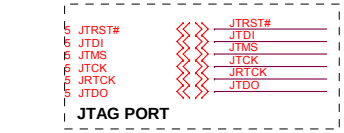

U17
PDA1 PDA2 PDA3 PDA4 PDA5 PDA6 PDA7 PDA8 PDA9 PDA10 PDA11 PDA12 PDA13 PDA14 PDA15 PDA16 PDA17 PDA18 PDA19 PDA20 PDA21 PDA22
POCE0# POOE0# POWE#
A0 A1 A2 A3 A4 A5 A6 A7 A8 A9 A10 A11 A12 A13 A14 A15 A16 A17 A18 A19 A20 A21
CE OE WE RESET
D0 D1 D2 D3 D4 D5 D6 D7 D8 D9 D10 D11 D12 D13 D14 D15/A-1
WP/ACC RY/BY BYTE VCC GND1 GND2
PDD0 PDD1 PDD2 PDD3 PDD4 PDD5 PDD6 PDD7 PDA0
NOR_WP# NOR_RY_BY0#
IC FLASH MX29LV320 32Mb TSOP-48
TSOP48/SMD
NOR FLASH #0
DV33
R87 4.7K R0603/SMD
R88 0 R0603/SMD
ORESET# NOR_RST#
C33 10pF C0603/SMD
R84 0 R0603/SMD
ORESET#
C32 NS/10pF C0603/SMD
R86 NS/4.7K R0603/SMD
CB145 0.1uF C0603/SMD
CE27 10uF/16v C10UF16V/D5H11
FB9 FB BEAD/SMD/0603
DV33

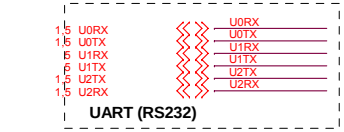


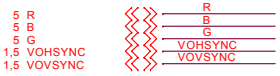


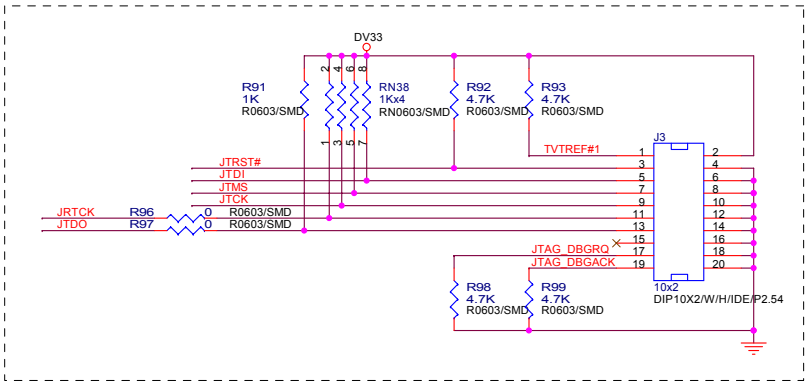


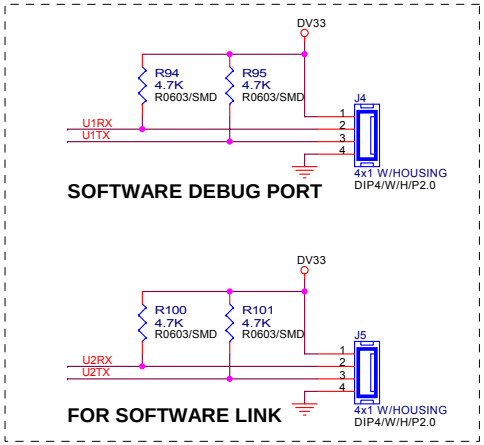


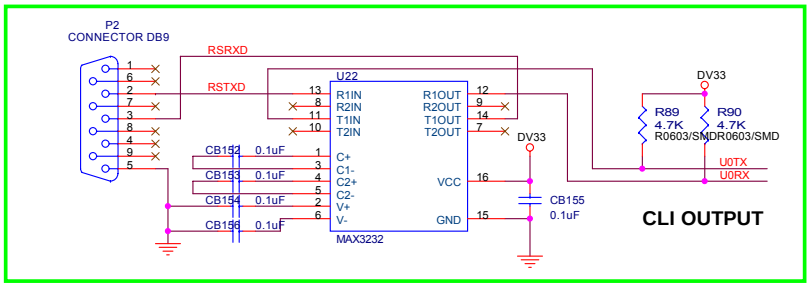


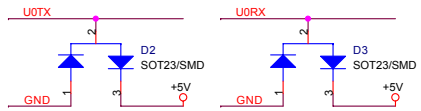












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Title	NOR FLASH / JTAG / UART	
Size: Custom	Document Number: MT5351RA-V2	Rev: 1
Date: Monday, February 20, 2006	TwinSon Chan	Sheet 8 of 8

Basic Operations & Circuit Description

MODULE

There are 1 pcs panel and 5 pcs PCB including 3 pcs Extension PCB, 1 pcs Timming controller board and 1 pcs Back Light board in the Module.

SET

There are 6 pcs PCBs including 1 pcs ATV Tuner board, 1 pcs keypad board, 1 pcs Remote Control Receiver board, 2 pcs L/R Speakers and 1 pcs Main(Video)board, 1 pcs ATSC board in the SET.

PCB funtion

1. Power :

   (1). Input voltage: AC 120V, 60Hz.

   (2). To provide power for PCBs.

2. Main board : To converter TV signals, S signals, AV signals, Y Pb/Cb Pr/Cr signals, DVI/HDMI signals and D-SUB signals to digital ones and to transmit to Control board.

3. Control board : Dealing with the digital signal for output to panel.

4. Extension board : Output addressing signals.

5. ATV Tuner Board : To convert TV RF signal to video and SIF audio signal to Main board.

6. ATSC Board : Receiver and converter ATSC TV signal to transmit to main board.

PCB failure analysis

1. CONTROL : a. Abnormal noise on screen. b. No picture.
2. MAIN : a. Lacking color, Bad color scale.
   b. No voice. (Make sure status: Mute / Internal, External speaker)
   c. No picture but with signals output, OSD and back light.
   d. Abnormal noise on screen.
3. POWER : NO picture, no power output.
4. Back Light : a. No picture.
   b. Flash on screen.
   c. Darker picture with signals.
5. ATV Tuner : a. No ATV Noise
   b. No ATV signals
6. ATSC: a No ATSC TV signal

Main IC Specifications

- M13S128168A (ESMT)
  2M x 16 Bit x 4 Banks Double Data Rate SDRAW

- MT5111CE
  Single-Chip HDTV/CATV Demodulator

- MT5351
  MT5351 is a DTV Backend Decoder SOC which support flexible transport demux, HD MPEG-2 video decoder, MPEG1,2, MP3, AC3 audio decoder, HDTV encoder. MT5351 is powered by ARM 926EJ with 16K I-Cache and 16K D-Cache. It can support 64Mb to 1Gb DDR DRAM devices with configurable 32/64 bit data bus interface.

- MT8202
  MT8202G is a highly integrated Single-Chip for LCD TV supporting video input and output format up to HDTV. It includes 3D comb filter TV decoder to retrieve the best image from popular composite signals.

- MT8293
  HDMI PanelLink Cinema Receiver

- R2S15102NP
  Digital Power Amplifier R2S15102NP

- WM8776
  24-bit, 192kHz Stereo CODEC with 5 Channel I/P Multiplexer

MT5111CE
Single-Chip HDTV/CATV Demodulator

Key Features

- Compliant with ATSC digital television standard
- Supports SCTE DVS-031 and ITU J.83 Annex B digital CATV standard
- Accepts direct IF (44 MHz or 43.75MHz) and low IF (5.38MHz)
- Differential IF input with programmable input signal level: 0.5Vpp to 2Vpp
- NTSC interference rejection capability
- Compensate echo up to -5 to +47*us* range for terrestrial HDTV reception
- On-chip 10-bit ADC for HDTV/CATV demodulator
- On-chip programmable gain amplifier
- 25MHz crystal for clock generation
- On-chip PLL clock generation
- Full-digital timing recovery, no VCXO is required
- Full-digital frequency offset recovery with wide acquisition range ±1MHz for ATSC and ±250kHz for CATV reception
- Dual digital AGC controls for IF and RF respectively
- MPEG-2 transport stream output in parallel or serial format
- On-chip error rate estimators for TS packets, TCM decoder, and equalizer
- EIA/CEA-909 antenna interface
- Controlled by I^2C interface
- Supports sleep mode to save power consumption
- Core power supply: 1.8V, peripheral power supply: 3.3V
- 100-LQFP package
- Lead Free

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Functional Block Diagram

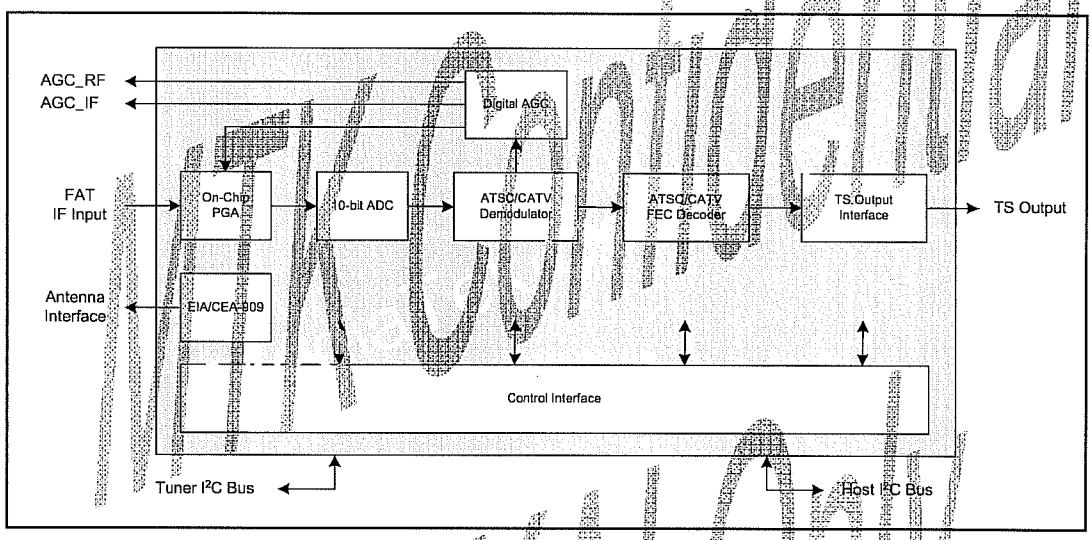

Figure 1: MT5111CE Functional Block Diagram

General Description

MT5111CE is a fully integrated single-chip 8-VSB and 64/256-QAM demodulator. The chip is designed specifically for the digital terrestrial HDTV and CATV receivers, and is fully compliant with ATSC A/53, SCTE DVS-031, and ITU J.83 Annex B standards.

MT5111CE includes a 10-bit A/D converter, 8-VSB/QAM demodulator, TCM (Trellis-Coded Modulation) decoder, and Reed-Solomon Forward Error Correction decoder. Moreover, an internal controller handles the acquisition and tracking to ensure the best receiving performance. The internal controller communicates with the external host controller via the I2C-compatible interface, and also provides direct control to the RF tuner via the second I2C-compatible

interface.

MT5111CE accepts either the direct IF signals centered at 44MHz or 43.75MHz, or the low IF signals centered at 5.38MHz. The center frequency of the incoming IF signal can also be programmed to other frequencies for various applications. An On-chip programmable gain-controlled amplifier is designed to provide sufficient signal amplitude when the received RF signal is weak. The IF signal is first sampled by a 10-bit A/D converter. Afterward, the digitized samples are further processed for adjacent channel interference rejection.

MT5111CE measures the power level of the digitized sequence, and feeds the control voltages back to the RF tuner and the IF amplifier respectively. The control voltages are converted to analog signals through the on-chip 1-bit sigma-delta D/A converters plus the off-chip R-C low-pass filters. The automatic gain control keeps the received power level at a desired level and maximizes the received SNR.

The carrier frequency offset and symbol timing offset are both estimated and compensated by a fully digital synchronizer. The synchronizer also controls the rate conversion in the digital re-sampling device by estimating the sampling frequency offset. All synchronization in MT5111CE are integrated in digital circuits, no external VCXO is required.

The equalizer is adopted to cancel the effect of multi-path fading channel during signal propagation in the air or over cable networks. The equalizer is not only capable of acquiring correct coefficients combination by specified adaptive algorithms, but also programmable to different configurations for various channel conditions.

The following FEC decoder corrects most of the errors by the concatenation

of TCM and Reed-Solomon decoders. For CATV reception, MT5111CE detects and aligns de-puncturing timing of the received sequence. The timing synchronization is also automatically performed to lock the FEC frames. The on-chip error rate estimator can simultaneously monitor the receiving qualities at the three stages: equalizer output, TCM decoder, and transport stream packets. The chip finally outputs the decoded MPEG-2 packets in either the serial or parallel transport stream format.

In addition to the demodulation of HDTV signal, MT5111CE also provides the capability to remove the NTSC co-channel interference. To achieve the best reception condition, an antenna interface compliant with EIA/CEA-909 is designed to control the antenna parameters.

MT5111CE is designed with efficient mechanisms of power saving. When configured to enter the sleep mode by the system host, it can immediately turn off almost all embedded hardware except the on-chip controller to reduce the power consumption. Resuming from sleep mode is also triggered by the system host. Upon returning to the operation mode, the chip will try to re-acquire the DTV signal automatically.

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Pin Out

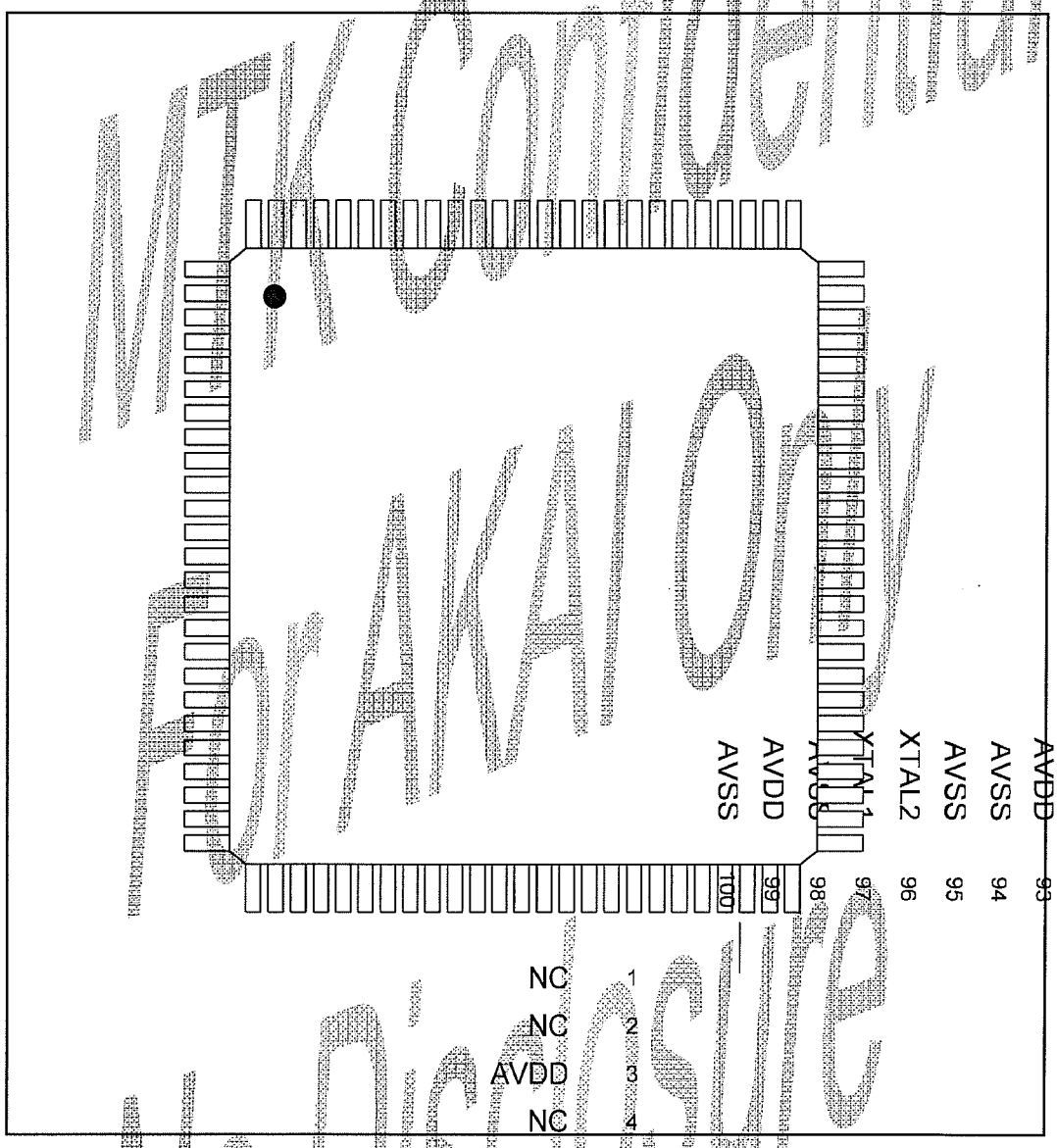

Figure 2: MT5111CE Pin Out

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Pin Description

Signal Name	Pin No	I/O	Description
Transport Stream			
TSDATA[7:0]	22,23,24,25,28, 29,32,33,	O	TS data output
TSSYNC	34	O	TS packet start signal
TSVAL	38	O	TS output valid signal
TSCLK	37	O	TS output clock
TSERR	39	O	TS packet error indicator
Analog Signal			
IN+	82	I	Analog differential IF input
IN-	81	I	
REFTOP	88	O	ADC reference top voltage. Decouple with a capacitor to AVSS
REFBOT	86	O	ADC reference bottom voltage. Decouple with a capacitor to AVSS
VCMEXT	87	O	ADC common mode voltage
Antenna Interface			
ANTIF	62	O	CEA-909 Antenna Control Interface
Clock Generation			
XTAL1	97	I	25MHz crystal input
XTAL2	96	I	
Control Signals			
HOST_CLK	47	I	Host processor serial clock input, 5 volt compatible
HOST_DATA	44	I/O	Host processor serial data pin, 5 volt compatible
TUNER_CLK	69	O	Tuner serial clock output, 5 volt compatible
TUNER_DATA	68	I/O	Tuner serial data pin, 5 volt compatible
IF_AGC	72	O	IF AGC output
RF_AGC	73	O	RF AGC output
RESET	48	I	Power reset pin, low active
SA0	66	I	Chip slave address selection pin, tie to VDD3.3 or DGND
SA1	67	I	Chip slave address selection pin, tie to VDD3.3 or DGND
Power Supply			
VDD3.3	17,26,35,42, 52,60,70	P	Digital power supply, tie to 3.3V
VDD1.8	18,30,40,45, 55,64,75	P	Digital power supply, tie to 1.8V
DGND	16,19,27,31, 36,41,43,46,51,56, 61,63,65,71,74	P	Digital ground, tie to digital ground plane
AVDD	3,10,12,80,83,91, 92,93,99	P	Analog power supply, tie to 3.3V
AVSS	7,11,79,85,89,94, 95,98,100		Analog ground, tie to analog ground plane
ADVDD3.3	15,76	P	Digital power supply for analog component, tie to 3.3V
AVDD1.8	90	P	Digital power supply for analog component, tie to 1.8V
Others			
NC	1,2,4,5,6,8,9,13,14, 20,21,49,50,53,54, 57,58,59,77,78,84		Not Connected

Table 1: Pin Description

Electrical Characteristic

Recommended Operating Condition

Symbol	Description	Min	Typical	Max	Unit
Tj	Chip Junction Temperature	-	-	125	°C
VDD1.8	1.8V Digital Core Power Supply Voltage	1.62	1.8	1.98	Volt
AVDD	3.3V Analog Power Supply Voltage	3.15	3.3	3.45	Volt
VDD3.3	3.3V Digital IO Power Supply Voltage	3	3.3	3.6	Volt
AVDD1.8	1.8V Analog Power Supply Voltage	1.7	1.8	1.9	Volt
VIH	Digital Input High Voltage	3	3.3	3.6	Volt
VIL	Digital Input Low Voltage	-	0	-	Volt

Table 2: Recommend Operating Condition

Typical Current and Power Dissipation (ASTC Mode)

Symbol	Description	Typical	Unit
I_VDD1.8	1.8V Digital Core Power Supply Current	350	mA
I_AVDD	3.3V Analog Power Supply Current	70	mA
I_VDD3.3	3.3V Digital I/O Power Supply Current	16	mA
I_AVDD1.8	1.8V Analog Power Supply Current	2	mA
P_VDD1.8	1.8V Digital Core Power Dissipation	630	mW
P_AVDD	3.3V Analog Power Dissipation	231	mW
P_VDD3.3	3.3V Digital IO Power Dissipation	52.8	mW
P_AVDD1.8	1.8V Analog Power Dissipation	3.6	mW
P_Total	Total Power Dissipation	917.4	mW
P_Sleep	Total Power Dissipation (Sleep Mode)	130	mW

Table 3: Typical Current and Power Dissipation (ATSC Mode)

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Typical Current and Power Dissipation (QAM Mode)

Symbol	Description	Typical	Unit
I_VDD1.8	1.8V Digital Core Power Supply Current	175	mA
I_AVDD	3.3V Analog Power Supply Current	70	mA
I_VDD3.3	3.3V Digital I/O Power Supply Current	19	mA
I_AVDD1.8	1.8V Analog Power Supply Current	2	mA
P_VDD1.8	1.8V Digital Core Power Dissipation	315	mW
P_AVDD	3.3V Analog Power Dissipation	231	mW
P_VDD3.3	3.3V Digital IO Power Dissipation	62.7	mW
P_AVDD1.8	1.8V Analog Power Dissipation	3.6	mW
P_Total	Total Power Dissipation	612.3	mW
P_Sleep	Total Power Dissipation (Sleep Mode)	130	mW

Table 4: Typical Current and Power Dissipation (QAM Mode)

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MEDIATEK

MT8293

Specifications are subject to change without notice

HDMI PanelLink Cinema Receiver

MT8293 is a low-cost, fully HDMI-compliant receiver that fits directly into home theater products such as LCD TVs, plasma TVs and HDTVs. The receiver is capable of supporting bandwidths up to 165MHz and video resolutions up to 1080p and UXGA. The MT8293 supports the DVD-Audio standard, including 7.1- surround audio at 96kHz and stereo audio at 192kHz.

The built-in High-bandwidth Digital Content Protection (HDCP) decryption engine secures the digital link for transmission of valuable high-definition video and audio.Built-in HDCP self-test engine simplifies manufacturing testing.

FEATHRES

- Industry-Standard
  - HDMI 1.1
  - DVI 1.0
  - EIA/CEA-861B
  - HDCP 1.1
- Digital Video Output
  - Integrated PanelLink Core
  - Supports DTV (480i/576i/480p/576p/720p/1080i/1080p) and PC (VGA/XGA/SXGA/UXGA) resolution up to 165MHz (using dual edge to transmit video data for pixel clock over 112MHz)
  - Flexible digital video interface
    - 24-bit RGB/YCbCr 4:4:4
    - 16-bit YCbCr 4:2:2
    - 8-bit YCbCr 4:2:2 (ITU-R BT.656)
  - Integrated RGB <-> YCbCr color space conversion (both 601 and 709)
  - 4:2:2 <-> 4:4:4 converter
  - Integrated Deinterlacer for 480i/576i (SDTV only)
  - Integrated Down-Scaler (with CEN)
- Digital Audio Output
  - Industry-standard S/PDIF and 3-wire output
  - Supports high-end audio including DVD-Audio
    - 2-ch. 32-192kHz or
    - 8-ch. 32-96kHz
  - Programmable 3-wire output supports numerous low-cost I2S audio DACs
  - Supports IEC60958 2-channel PCM
  - Capable of carrying IEC61937 compressed audio (Dolby Digital, DTS, etc.)
- Content Protection
  - Integrated HDCP cipher engine
  - External EEPROM for encrypt HDCP keys
  - Built-in HDCP self-test
  - Decrypts both video and audio
- System Operation
  - Register-programmable via slave I2C interface
  - Auto video mode
  - Auto audio mode
  - Flexible interrupt registers with interrupt pin
- Power Management
  - 1.8V core provides low-power operation
  - Flexible power-down modes
- Outline
  - 128-pin QFP package

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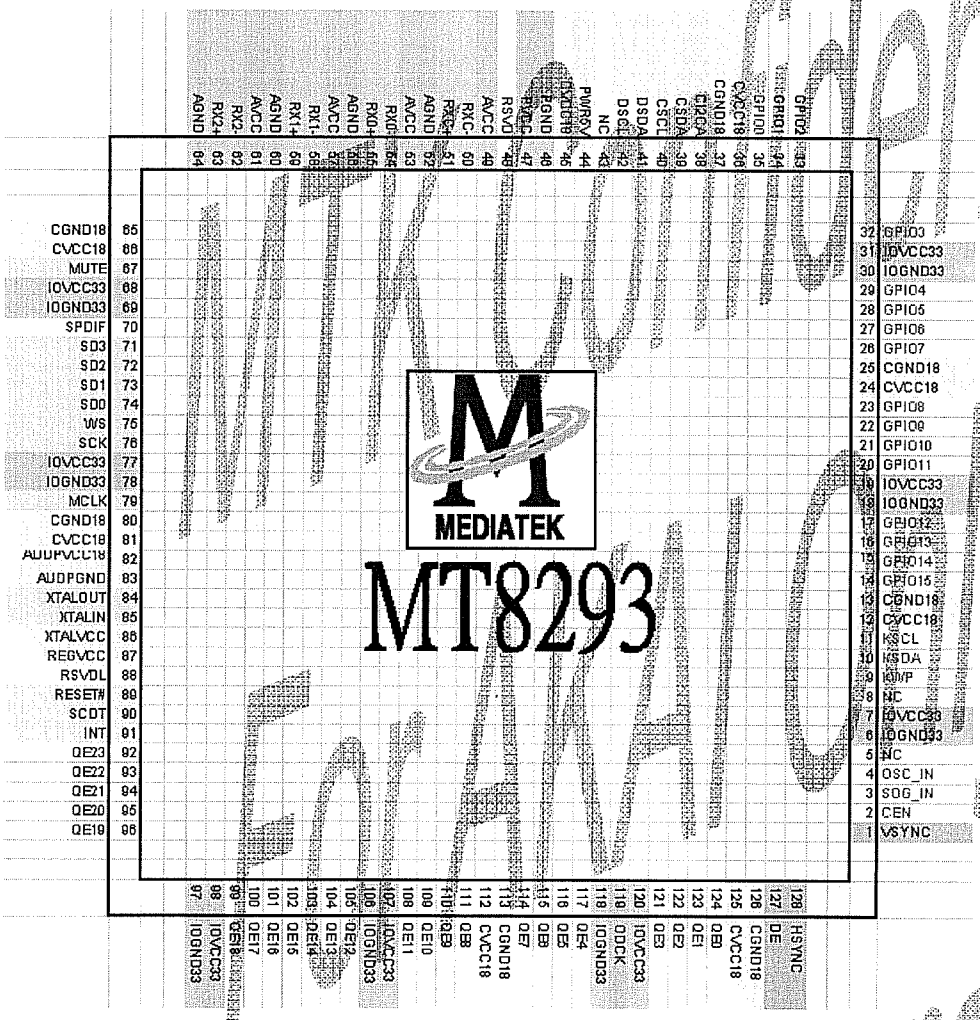

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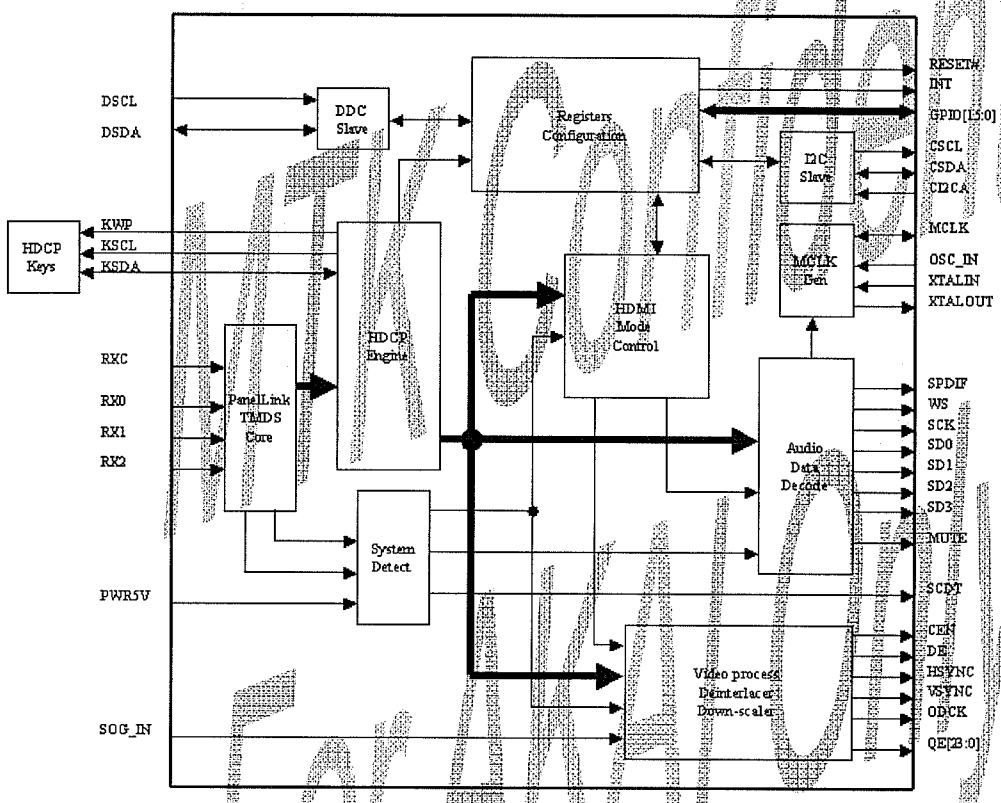

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Item	Symbol	Pin #	Type	Description
DIGITAL				
Power/Ground (45)				
1	CVCC18	12,24,36,45,66,81,112,125	I	Digital Logic 1.8V power
2	CGND18	13,25,37,65,80,113,126	I	Digital Logic ground
3	IOVCC33	7,19,31,68,77,98,107,120	I	Input/Output Pin 3.3V power
4	IOGND33	6,18,30,69,78,97,106,118	I	Input/Output Pin ground
5	AVCC	49,53,57,61	I	TMDS Analog 3.3V power
6	AGND	52,56,60,64	I	TMDS Analog ground
7	PVCC	47	I	TMDS PLL 3.3V power
8	PGND	46	I	TMDS PLL ground
9	AUDPVCC18	82	I	ACR PLL 1.8V power
10	AUDPGND	83	I	ACR PLL ground
11	XTALVCC	86	I	ACR PLL crystal input 3.3V power
12	REGVCC	87	I	ACR PLL regulator 3.3V power
Configuration/Programming (20)				
1	INT	91	O	Interrupt output
2	RESET#	89	I	Reset Pin. Active low
3	DSCL	42	I	DDC I2C clock, 5V tolerance
4	DSDA	41	I/O	DDC I2C data, 5V tolerance
5	CSCL	40	I	Configuration I2C clock
6	CSDA	39	I/O	Configuration I2C data
7	KSCL	11	O	KEYS EEPROM I2C clock
8	KSDA	10	I/O	KEYS EEPROM I2C data
9	KWP	9	O	KEYS EEPROM write protect
10	SCDT	90	O	Indicates active video at HDMI input port
11	CISCA	38	I	I2C device address select

Item	Symbol	Pin #	Type	Description
12	PWR5V	44	I	TMDS port transmitter detect (hot plug), 5V tolerance
13	RSVDL	88	I	Must be tied low
14	RSVD	48	O	
15	NC	43	-	No connect
16	NC	8,5	-	No connect
17	OSC_IN	4	I	Oscillator input, External in
18	SOG_IN	3	I	SOG input, External AD in
19	CEN	2	O	Clock enable, for 8202 CEN input
Digital Audio Interface (9)				
1	MCLK	79	I/O	Audio master clock input reference
2	SCK	76	O	I2S serial clock output
3	WS	75	O	I2S word select output
4	SD0	74	O	I2S serial data output
5	SD1	73	O	I2S serial data output
6	SD2	72	O	I2S serial data output
7	SD3	71	O	I2S serial data output
8	SPDIF	70	O	S/PDIF audio output
9	MUTE	67	O	Mute audio output
GPIO Interface (16)				
1	GPIO0	35	I/O	GPIO
2	GPIO1	34	I/O	GPIO
3	GPIO2	33	I/O	GPIO

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Item	Symbol	Pin #	Type	Description
4	GPIO3	32	I/O	GPIO
5	GPIO4	29	I/O	GPIO
6	GPIO5	28	I/O	GPIO
7	GPIO6	27	I/O	GPIO
8	GPIO7	26	I/O	GPIO
9	GPIO8	23	I/O	GPIO
10	GPIO9	22	I/O	GPIO
11	GPIO10	21	I/O	GPIO
12	GPIO11	20	I/O	GPIO
13	GPIO12	17	I/O	GPIO
14	GPIO13	16	I/O	GPIO
15	GPIO14	15	I/O	GPIO
16	GPIO15	14	I/O	GPIO
TTL Interface (28)				
1	DE	127	O	Data enable
2	VSYNC	1	O	Vertical sync
3	HSYNC	128	O	Horizontal sync
4	ODCK	119	O	Output data clock
5	QE0	124	O	24-bit Even pixel
6	QE1	123	O	24-bit Even pixel
7	QE2	122	O	24-bit Even pixel

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Item	Symbol	Pin #	Type	Description
8	QE3	121	O	24-bit Even pixel
9	QE4	117	O	24-bit Even pixel
10	QE5	116	O	24-bit Even pixel
11	QE6	115	O	24-bit Even pixel
12	QE7	114	O	24-bit Even pixel
13	QE8	111	O	24-bit Even pixel
14	QE9	110	O	24-bit Even pixel
15	QE10	109	O	24-bit Even pixel
16	QE11	108	O	24-bit Even pixel
17	QE12	105	O	24-bit Even pixel
18	QE13	104	O	24-bit Even pixel
19	QE14	103	O	24-bit Even pixel
20	QE15	102	O	24-bit Even pixel
21	QE16	101	O	24-bit Even pixel
22	QE17	100	O	24-bit Even pixel
23	QE18	99	O	24-bit Even pixel
24	QE19	96	O	24-bit Even pixel
25	QE20	95	O	24-bit Even pixel
26	QE21	9	O	24-bit Even pixel
27	QE22	93	O	24-bit Even pixel
28	QE23	92	O	24-bit Even pixel

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Item	Symbol	Pin #	Type	Description
ANALOG (8)				
Differential signal				
1	RXC+	51	I	TMDS input clock pair
1	RXC-	50	I	TMDS input clock pair
1	RX0	55	I	TMDS input data pair
1	RX0	54	I	TMDS input data pair
1	RX1	59	I	TMDS input data pair
1	RX1	58	I	TMDS input data pair
1	RX2	63	I	TMDS input data pair
1	RX2	62	I	TMDS input data pair
PLL group(2)				
68	XTALIN	85	I	Crystal input PAD
69	XTALOUT	84	O	Crystal output PAD

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MEDIATEK

MT8202

HDTV-Ready LCD TV Chip

Specifications are subject to change without notice

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Not Recommended for New Design

MT8202 is a highly integrated single chip for LCD TV supporting video input and output format up to HDTV. It includes 3D comb filter TV decoder to retrieve the best image from popular composite signals. Embedded HDTV/VGA decoders let the high bandwidth input signals perfectly reproduced. 24/16/8 bits digital port may accept all kinds of external digital input video source. New 2nd generation advanced motion adaptive de-interlacer converts accordingly the interlace video into progressive one with overlay of a 2D Graphic processor. Advanced full function color processing with fully 10-bit path provides high quality video contents. Independent two Flexible scalers provide wide adoption to various LCD panels for two of different video sources at the same time. Its on-chip audio processor decodes analog signals from tuner with lip sync control, delivering high quality post-processed sound effect to customers. On-chip microprocessor reduces the system BOM and shortens the schedule of UI design by high level C program. MT8202 is a cost-effective and high performance HDTV-ready solution to LCD TV manufactures.

FEATURES

- Video Input
  - Support fully programmable 8 Composite/SV input pins
  - Support 2 Component inputs with SDTV format & HDTV 480p/720p/1080i format
  - Support 1 VGA input up to SXGA (1280x1024x75Hz) including SOG signals
  - Support DVI 24-bit RGB digital input
  - Support CCIR-656/601 digital input
- TV decoder
  - Full 10-bit data path to enhance the video resolution and reduce digital truncation errors
  - Support PAL (B,G,D,H,M,N,I,Nc), PAL(Nc), PAL, NTSC, NTSC-4.43, SECAM
  - Automatic Luma/Chroma gain control
  - Automatic TV standard detection
  - 2nd generation NTSC/PAL Motion Adaptive 3D comb filter with huge improvement
  - Motion Adaptive 3D Noise Reduction
  - VBI decoder for Closed-Caption/XDS/ Teletext/WSS/VPS
  - High speed advanced Teletext/Closed-Caption drawing engine directly on OSD plane
  - Macrovision detection
  - Adjustable horizontal delay for combination of SCART Composite/RGB input
- Video Processor
  - Fully 10-bit processing to enhance the video quality
  - Advanced flesh tone and color processing
  - Gamma/anti-Gamma correction
  - Advanced Color Transient Improvement (CTI)
  - 2D Peaking
  - Advanced horizontal/vertical sharpness
  - Saturation/hue adjustment
  - Brightness and contrast adjustment
  - Black level extender
  - White peak level limiter
  - Adaptive Luma/Chroma management
  - Automatic detect film or video source
  - 3:2/2:2 pull down source detection
  - 2nd generation Advanced Motion adaptive de-interlacing
  - Arbitrary ratio vertical/horizontal scaling of video, from 1/32X to 32X
  - Advanced linear and non-linear Panorama scaling
  - Programmable Zoom viewer
  - Progressive scan output
  - Picture-in-Picture (PIP)
  - Picture-Out-Picture (POP)
  - Advanced dithering processing for LCD display with 6/8/10 bit output
  - Frame rate conversion, 50Hz to 75Hz
- Audio DSP
  - Support BTSC/EIAJ/A2/NICAM decode
  - Stereo demodulation, SAP demodulation

- Noise reduction
- Mode selection (Main/SAP/Stereo)
- Pink noise and white noise generator
- Equalizer
- Sub-woofer/Bass enhancement
- Noise auto mute
- 3D surround processing include virtual surround
- Audio and video lip synchronization
- Support Reverberation

Audio Input/Output

- Decode audio AF from Tuner
- 2 channel audio L/R digital line in
- 7.1-channel slave digital line in
- Including full 7.1-channels digital output, 2-channel bypass and 2-channel headphone output
- Embedded 3 internal DAC output

DRAM Controller

- Supports up to 32M-byte SDR/DDR DRAM
- Supports 2x16 bit SDR/DDR bus interfaces
- Build in a DRAM interface programmable clock to optimize the DRAM performance
- Programmable DRAM access cycle and refresh cycle timings
- Support 3.3/2.5-Volt SDR/DDR Interface

Video Output

- TV pattern generator for testing
- Interlaced 50Hz to 120Hz
- Support up to 1366 horizontal points
- 6/8/10-bit single channel or 6/8/10-bit dual channel LVDS output
- Support video output mirror and upside down

2D-Graphic/3 OSD processor

- Embedded Two backend RGB domain OSD planes and one YUV domain OSD
- Support Text/Bitmap decoder
- Support line/rectangle/gradient fill
- Support bitblt
- Support color Key function
- Support Clip Mask
- Support Alpha blending with video output
- 65535/256/16/4/2-color bitmap format OSD,
- Automatic vertical scrolling of OSD image
- Support OSD mirror and upside down

Host Micro controller

- Turbo 8032 micro controller
- Built-in internal 373 and 8-bit programmable lower address port
- 2048-bytes on-chip RAM
- Up to 4M bytes FLASH-programming interface
- Supports 5/3.3-Volt FLASH interface
- Supports power-down mode
- Supports additional serial port
- IR control serial input
- Support 2 RS232 interface for external source communication
- Support 2 PWM output
- Support DDC2Bi/DDC2B/DDC1/DDCCI
- Programmable GPIO setting for complex external device control

Outline

- 388-pin BGA package
- Lead Free
- 3.3/2.5/1.8-Volt operating voltages
- 0.18um process

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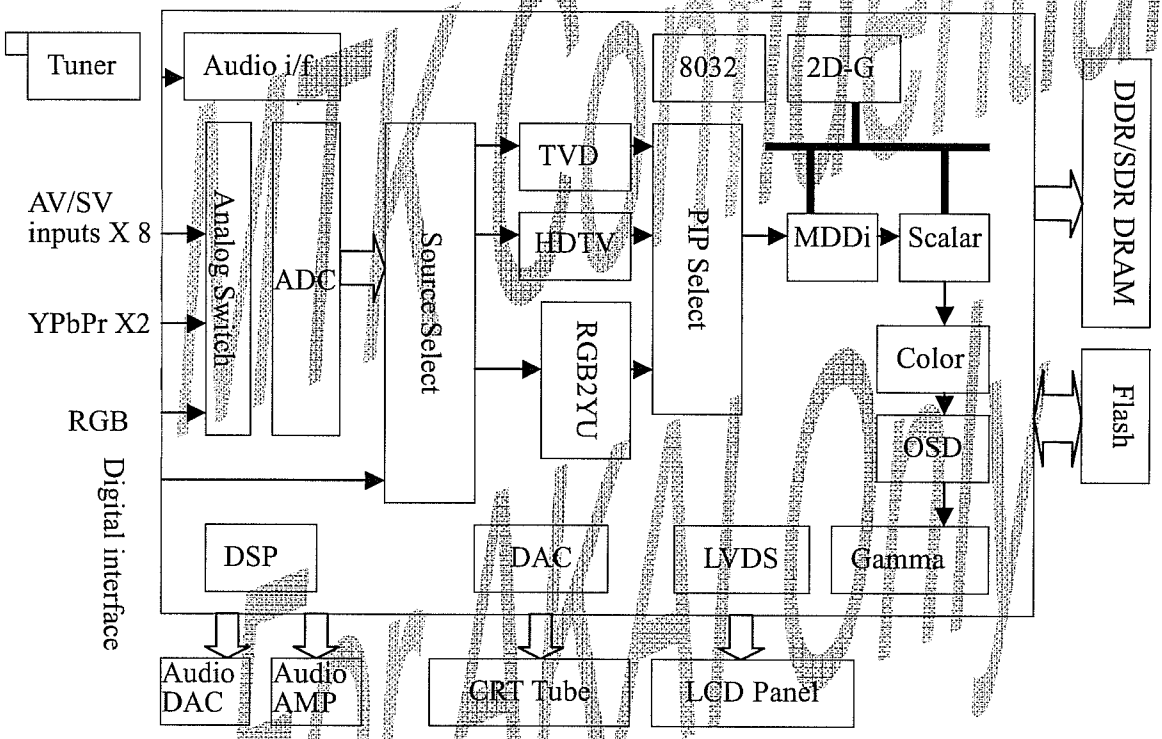
BLOCK DIGRAM



Analog Switch

Analog switches are built in MT8202 to connect to 17 input signals and there is need to add external components to add analog video multiplexes on board.

There are 9 high-speed differential input pairs for 3 sets of YPRPB/VGA input signals.

The 8 Composite/S signal input pins can be fully programmed to connect to any AV/SV inputs.

ADC/ Source Select

The video ADC sample analog input signals. After ADC, all signal processing is digital domain. The source select multiplex all inputs from digital and analog video ports and route them into data path.

Audio Interface

Audio interface accept analog audio signal from Tuner, e.g. AF. It also includes preprocessing circuit to filter the noisy audio signals. Audio decoder will decode the BTSC or NICAM, and output best sound with enhanced 3D surround post-processing.

Embedded 7.1 channel digital audio input (slave) and 2 channels (master) digital audio inputs.

Embedded 3 high performance audio DACs.

DSP

DSP handle audio decoding as well as computing intensive jobs. The downloadable micro code enables fast function convergence for various audio standards in the world.

Advanced DSP engine supports full functions of sound effects.

MDDi/Scaler

MDDi is MTK proprietary de-interlacing technology, 2nd generation MDDi solution provides improved low angle processing and more accurate motion detection for all interlace sources. The techniques reduce jagged edges and broken images. The MDDi engine supports both Main and Sub channel SDTV inputs or one channel 1080i high quality de-interlacing.

Two totally independent scaler support full functions of PIP/POP and frame rate conversion.

With MDDi and high quality scaler, MT8202 guarantee all input format could be translated to output format with best video quality for motion and still pictures.

Color/Gamma

MT8202 includes advanced color management function to allow user to improve video quality with fully flexibility. With contrast/hue/saturation/Gamma/anti-Gamma/flesh tone function, MT8202 deliver the best video quality with vivid color.

Advanced dither function support 6/8/10-bit video output for any kinds of display unit (LCD, PDP, CRT).

8032

On-chip Turbo8032 provide the most cost effective development environment for system house. Well-proven F/W could speed up the system design significantly.

2D-G/OSD

On-chip graphic engine draw bitmap OSD and store them into DRAM. OSD read data from DRAM and display on screen. With 2D-G and OSD. The computing power requirement of μP will be minimized.

One YUV space OSD added to support Main/PIP Teletext/Close-caption functions.

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MEDIATEK

MT5351

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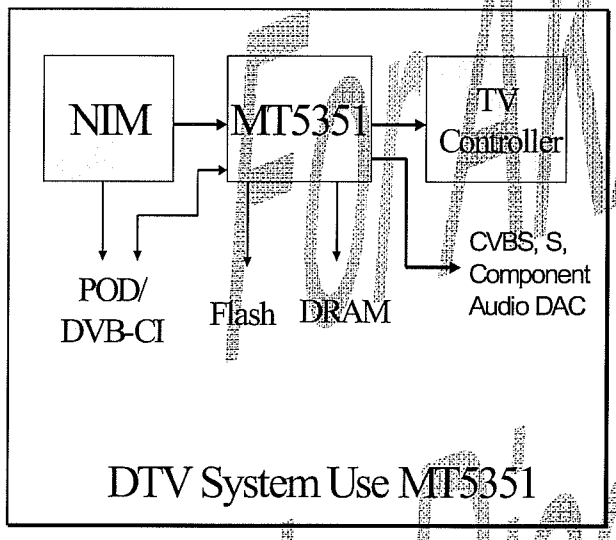
DTV Backend Decoder SOC

MediaTek MT5351 is a DTV Backend Decoder SOC which support flexible transport demux, HD MPEG-2 video decoder, JPEG decoder, MPEG1,2, MP3, AC3 audio decoder, HD TV encoder. The MT5351 enables consumer electronics manufactures to build high quality, feature-rich DTV, STB or other home entertainment audio/video device.

World-Leading Technology: HW support worldwide major broadcast network and CA standards, include ATSC, DVB, OpenCable, DirectTV, MHP.

Rich Feature for high value product: To enrich the feature of DTV, the MT5351 support 1394-5C component to external DVHS. Dual display, PIP/POP and quad pictures provide user a whole new viewing experience.

Credible Audio/Video Quality: The MT5351 use advanced motion-adaptive de-interlace algorithm to achieve the best movie/video playback. The embedded 4X over-sample video DAC could generate very fine display quality. Also, the audio 3D surround and equalizer provide professional entertainment



DTV System Use MT5351

Key Features:

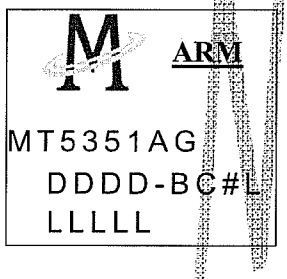
1. Flexible Demuxer
2. Dual HD MPEG2 Video Decoder
3. Dual MPEG1,2, MP3, AC3 Audio decode
4. Dual Display
5. PIP/POP/Quad Mode
6. IEEE1394-5C
7. POD/DVB-CI

Application:

1. DTV
2. Set-top Box
3. DTV Recorder
4. Home Media Center

Order Information:

MT5351AG → one HD decoder
MT5351CG → two HD decoder
All Package are Lead Free



IC Top View:

DDDD: Date Code
#: Subcontractor Code
LLLLL: Lot Number

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General Feature List

- Host CPU
  - ARM 926EJ
  - 16K I-Cache and 16K D-Cache
  - 8K Data TCM and 8K Instruction TCM
  - JTAG ICE interface
  - Watch Dog timers
- Transport Demuxer
  - Support 3 independent transport stream inputs.
  - Support serial / parallel interface for each transport stream input.
  - Support ATSC, DVB, and MPEG2 transport stream inputs.
  - Programmable sync detection.
  - Support DES/3-DES de-scramble
  - 96 PID filter and128 section filters.
  - Support TS recording via IEEE1394 interface
- MPEG2 Decoder
  - Support dual MPEG-2 HD decoder or up to 8 SD decoder
  - Complaint to MP@ML, MP@HL and MPEG-1 video standards
- JPEG Decoder
  - Decode Base-line or progressive JPEG file
- 2D Graphics
  - Support multiple color modes
  - Point, horizontal/vertical line primitive drawing
  - Rectangle fill and gradient fill functions
  - BitBlt with transparent, alpha blending, alpha composition and stretch
  - Font rendering by color expansion
  - Support clip masks
  - YCbCr to RGB color space transfer
- OSD Display
  - 3 linking list OSDs with multiple color mode
  - OSD scaling with arbitrary ratio from 1/2x to 2x
  - Square size, 32x32 or 64x64 pixel, hardware cursor
- Video Processing
  - Advanced Motion adaptive de-interlace on SDTV resolution
  - Support clip
  - 3:2/2:2 pull down source detection
  - Arbitrary ratio vertical/horizontal scaling of video, from 1/15X to 16X
  - Support Edge preserve
  - Support horizontal edge enhancement
  - Support Quad-Picture
- Main Display
  - Mixing two video and three OSD and hardware cursor
  - Contrast/Brightness adjustment
  - Gamma correction
  - Picture-in-Picture (PIP)
  - Picture-Out-Picture (POP)
  - 480i/576i/480p/576p/720p/1080i output
- Auxiliary Display
  - Mixing one video and one OSD
  - 480i/576i output
- TV Encoder
  - Support NTSC M/N, PAL M/N/B/D/G/H/I
  - Macrovision Rev 7.1.L1
  - CGMS/WSS
  - Closed Captioning
  - Six12-bit video DACs for CVBS, S-video or RGB/YPbPr output
- Digital Video Interface
  - Support SAV/EAV
  - Support 8/16 for SD/HD digital video input
  - Support 8/16/24 bits digital output for main display
  - Support 8 bits digital output for aux display
- DRAM Controller
  - Supports 64Mb to 1Gb DDR DRAM devices
  - Configurable 32/64 bit data bus interface
  - Support DDR266, DDR333, DDR400 JEDEC specification compliant SDRAM
- Peripheral Bus Interface
  - Support NOR/NAND flash
  - Support CableCard host control bus
- Audio

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- Support Dolby Digital AC-3 decoding
- MPEG-1 layer I/II, MP3 decoding
- Dolby prologic II
- Main audio output: 5.1ch + 2ch (down mix)
- Auxiliary audio output: 2ch
- Pink noise and white noise generator
- Equalizer
- Bass management
- 3D surround processing include virtual surround
- Audio and video lip synchronization
- Support reverberation
- SPDIF out
- I2S I/F

■ Peripherals

- Three UARTs with Tx and Rx FIFO, two of them have hardware flow control
- Two serial interfaces, one is master only; the other can be set to master mode or slave mode
- Two PWMs
- IR blaster and receiver
- IEEE 1394 link controller
- IDE bus: ATA/ATAPI7 UDMA mode 5, 100 MB/s
- Real-time clock and watchdog controller
- Memory card I/F: MS/MS-Pro, SD, CF, and MMC
- PCMCIA/POD/CI interface

■ IC Outline

- 471 Pin BGA Package
- 3.3V/1.2V dual Voltage

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Electrical Characteristics

Absolute Maximum Rating

Symbol	Parameters	Value	Unit
IOVDD	3.3V supply voltage	-0.5 to 4.6	V
CVDD	1.2V supply voltage	-0.5 to 1.8	V
AVDD	Analog supply voltage	-0.5 to 4.6	V
RVDD	DDR supply voltage	-0.5 to 3.5	V
VIN(3.3V)	Input Voltage(3.3V IO)	VSS-1.0 to 3.63	V
VIN(5V tolerance)	Input Voltage(5V tolerance IO)	VSS-1.0 to 5.5	V
Vout	Output Voltage	-0.3 to VDD3+0.3	V
Ts	Storage Temperature	-40 to 150	C
Ta	Ambient Temperature	0 to 70	C

DC Characteristics

Symbol	Parameters	Min	Typ	Max	Unit
IOVDD	3.3V supply voltage	2.97	3.3	3.63	V
CVDD	1.2V supply voltage	1.08	1.2	1.32	V
AVDD	Analog supply voltage	2.97	3.3	3.63	V
VIH(3.3V)	3.3V input voltage high	2.0			V
VIL(3.3V)	3.3V input voltage low			0.8	V
VOH(3.3V)	3.3V output voltage high	2.4			
VOL(3.3V)	3.3V output voltage low			0.4	
VIH(3/5V)	3/5V tolerance input voltage high	2.0			V
VIL(3/5V)	3/5V tolerance input voltage low			0.8	V
VOH(3/5V)	3/5V tolerance output voltage high	2.4			V
VOL(3/5V)	3/5V tolerance output voltage low			0.4	V
Tj	Junction operation temperature	-40	25	125	C
PD(estimate)	Power dissapation		1.5		W
Pdown	Power down mode		2		mW

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DDR ELECTRICAL Characteristics and DC Operating Condiction

Symbol	Parameters	Min	Typ	Max	Unit
RVDD(DDR333)	DDR I/O supply voltage for DDR266 or DDR333	2.3	2.5	2.7	V
RVDD(DDR400)	DDR I/O supply voltage for DDR400	2.5	2.6	2.7	V
DVREF	DDR I/O reference voltage	0.49*RVDD	0.5*RVDD	0.51*RVDD	V
VTT	DDR I/O termination voltage	VREF-0.04	VREF	VREF+0.04	V
VIH	DDR input voltage high	VREF+0.15		RVDD+0.3	V
VIL	DDR input voltage low	-0.3		VREF-0.15	V

DDR AC Operating Condiction

Symbol	Parameters	Min	Typ	Max	Unit
VIH	Input high voltage, DQ, DQS	DVREF+0.31			V
VIL	Input low voltage, DQ, DQS			DVREF-0.31	V
Vslew	Input minimum slew rate	1.0			V/ns
Vswing	Input maximum swing			1.5	V

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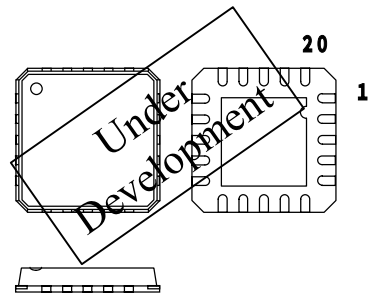
10Wx2ch(SE)/20Wx1ch(BTL) Digital Audio Power Amplifier

1.Outline

R2S15102NP is a Digital Power Amplifier IC developed for TV.
R2S15102NP can realize maximum Power 10W × 2ch
(VD = 24V,THD = 10%, SE) at 8 Ω load.
It is possible to replace from the conventional analog amplifier system to the digital amplifier system easily.

Fig. 1 Package



20pin QFN
Body : 6 x 6 mm
Lead pitch : 0.8 mm

2.Feature

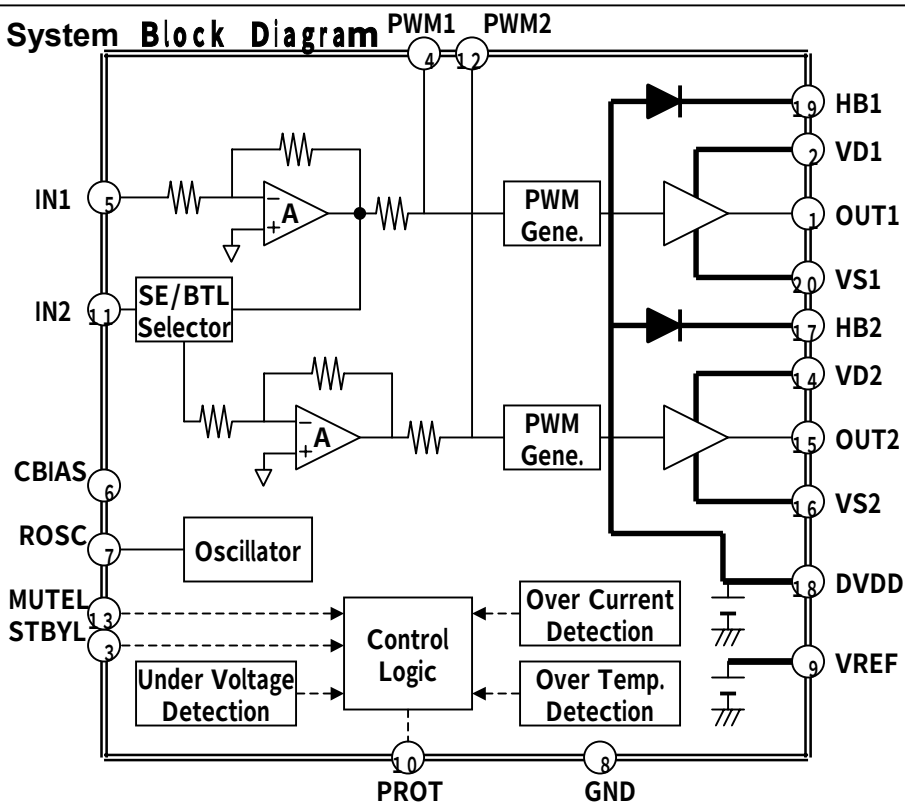
- **High** Output Power(THD=10%)**without external Heat Sink**
  (note) the thermal pad is soldered the thermal pad with the printed-circuit board directly.
  Recommanded Power Condition
  SE operation mode :10Wx2ch(VD=24V) at 8 Ω
  BTL operation mode: 20Wx1ch(VD=18V) at 8 Ω
- The RENESAS original circuits realize high power efficiency, low noise and low distortion characteristics.
- **Pop sound Less**
- **Built-in protection function**
  (Over Current, Over Temperature and Under Voltage)
- **Built-in Mute and Stand-by function**

3.Operating Condition

- **Recommanded** Power supply voltage : **from 11V to 25V**
- **Recommanded** Speaker Impedance : from 4 to 8Ω

4.Block Diagram

Fig. 2 System Block Diagram



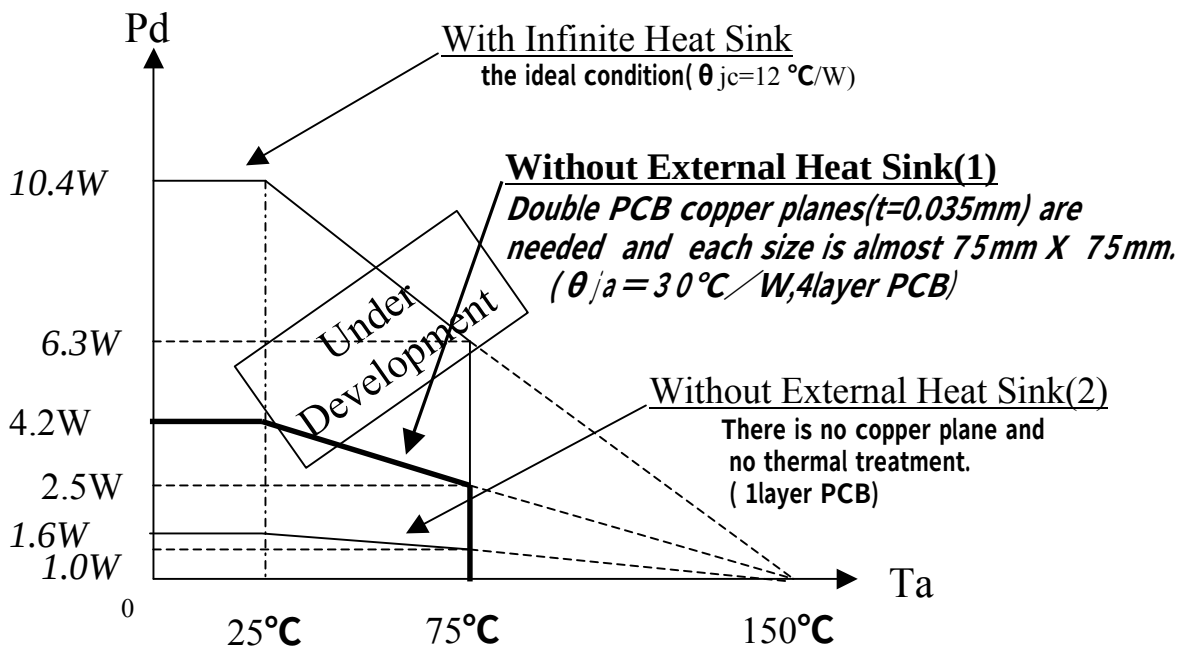
5. Pin Configuration(Table.1)

No.	NAME	I/O	Description	
1	OUT1	O	Power Output pin #1	
2	VD1	—	Power supply pin for power output stage #2	
3	STBYL	I	Stand-by control pin. When this is “L”, circuit current is reduced.There is the pull-down resistor:50Kohm(typ.).	
4	PWM1	I	PWM input pin #1 (for phase compensation)	
5	IN1	I	Analog input #1. The gain is depended on the external resistance .	
6	CBIAS	I/O	A capacitor is connected so that it may not be influenced of power supply change(Ripple Filter).	
7	ROSC	I	Control pin for PWM carrier frequency	
8	GND	—	GND pin for analog block	
9	VREF	I/O	Capacitor connection pin for analog block reference voltage source	
10	PROT	O	Protection Timer pin. At protection mode,the output becomes “L”-level. (The timing capacitor is connected)	
11	IN2	I	SE operation	Analog input #2(as same as IN1)
		I	BTL operation	When this is connected to DVDD pin via the resister, Reversed signal of OUT1 is output to OUT2.
12	PWM2	I	PWM input pin#2 (for phase compensation)	
13	MUTEL	I	Mute control pin. When this is “L”, it becomes mute status.	
14	VD2	—	Power supply pin for power output stage #2	
15	OUT2	O	Power Output pin #2	
16	VS2	—	Ground pin for power output stage #2	
17	HB2	I/O	Capacitor connection pin for bootstrap	
18	DVDD	O	Built-in power supply pin for internal digital block.	
19	HB1	I/O	Capacitor connection pin for bootstrap #1	
20	VS1	—	Ground pin for power output stage #1	

6. Absolute Maximum Rating(Table.2)

Symbol	Parameter	Condition	Value	Unit
VD max	Maximum VD Voltage	VD1,VD2 pin voltage	27	V
HB max	Maximum HB Voltage	HB1、HB2 pin voltage	40	V
Pd	Power dispassion	Ta = 25°C :See Fig.3	4.2	W
θja	Thermal Resistance	See Fig.3	30	℃/W
Tj	Junction temperature	Maximum Temperature	150	℃
Ta	Operating ambient temperature	Temperature range	-20～75	℃
Tstg	Storage temperature	Temperature range	-40～150	℃

Fig.3 Thermal De-rating(on PCB: printed-circuit board):Size 75mm x 75mm

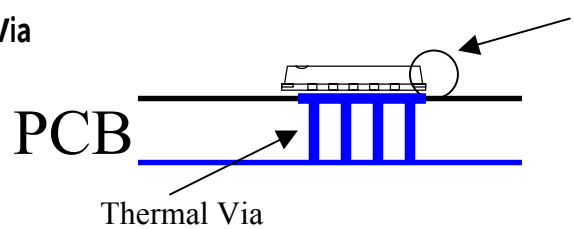


(NOTE)

PCB pattern design for high effective thermal conductivity

(1)The exposed die pad is directly soldered with the printed-circuit board pattern .

(2)Thermal Via



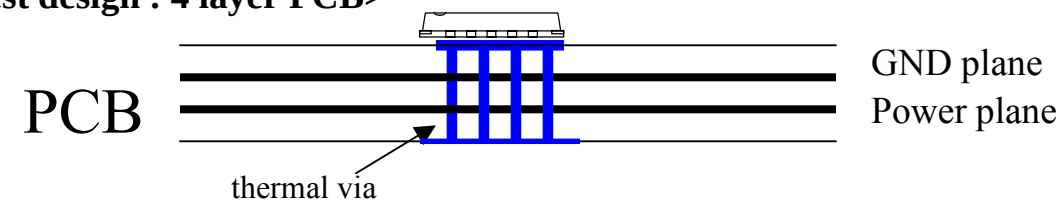
(caution)
There are side expositions of the die pad at corners of the package.
(The die pad is grounded.)

Consideration about the PCB design

The Power dispassion at 10Wx2ch(SE) or 20Wx1ch(BTL) is estimated almost 2W. It has enough margin, designing the PCB at θja=30℃/W.

(1)PCB basic design (copper plane)

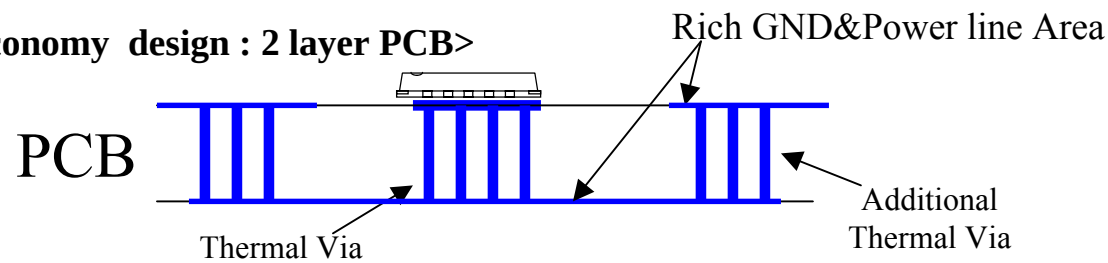
<the best design : 4 layer PCB>



<PCB size estimation >

10Wx2ch: 75mm x 75mm

<the economy design : 2 layer PCB>



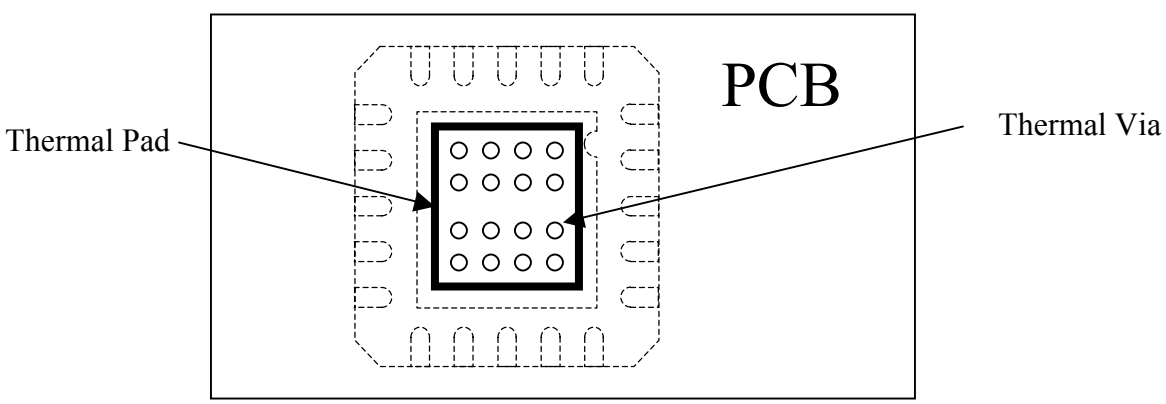
The GND&Power line total area size is also equal to the above GND&Power line total area size of the 4layer PCB.

<PCB size estimation >

10Wx2ch: (75+α)mm x (75+α) mm

(2)PCB Thermal Pad

The exposed die pad is directly soldered with the printed-circuit board pattern .



7. Recommended Operating condition(Table.3)

Symbol	Parameter	Condition	MIN	TYP	MAX	Unit
VD	Supply Voltage	VD1,VD2 pin voltage	11	-	25	V
VH	Control voltage of high level	STBYL、MUTEL	2	-	5	V
VL	Control voltage of low level	STBYL、MUTEL	0	-	0.8	V
fosc	Carrier Frequency	R= 33kΩ	300	400	600	kHz

(note) ・STBYL: High level:normal operation Low level:Stand-by
・MUTEL:High level:normal operation Low level:Mute
・The carrier frequency can be changed by the resistance at Pin#.7 .

8. Electronic Characteristics(Table.4)

(Unless otherwise noted, Ta=25°C, VD=24V, Carrier Frequency=400kHz, f=1kHz,SE operation)

Symbol	Parameter		Condition	MIN	TYP	MAX	Unit
IVD	Circuit Current		No Signal	TBD	28	TBD	mA
			MUTE	TBD	-	TBD	mA
			Stand-by	-	-	10	uA
VDPR	Detection Voltage		VD under-voltage	TBD	9.8	TBD	V
TPR	Protection Temperature		Thermal Shut-dawn	-	150	-	℃
TRL	Release Temperature		Thermal Shut-dawn	-	120	-	℃
IPR	Protection Current		Output over-current	-	6	-	A
Pomax	Maximum output power	at SE	THD=10%、VD=24V、RL=8Ω	TBD	10	-	W/ch
		at BTL	THD=10%、VD=18V、RL=8Ω	TBD	20	-	W
THD	Total Harmonic Distortion		Po=1W	-	0.1	TBD	%
No	Output Noise level		A-Weighted filter	-	(100)	TBD	uVrms
Eff	Power Efficiency	at SE	Po=10+10W	TBD	93	-	%
		at BTL	Po=20W	TBD	89	-	%
Mute	Mute Attenuation			TBD	80	-	dB
PSRR	Ripple Rejection Ratio		dVD=100mVrms,f=100Hz	TBD	50	-	dB

9. Application Examples

(note)
"R for GND" 's are for the evaluation only and not needed actually.

Fig.4 SE operation mode(10Wx2ch)

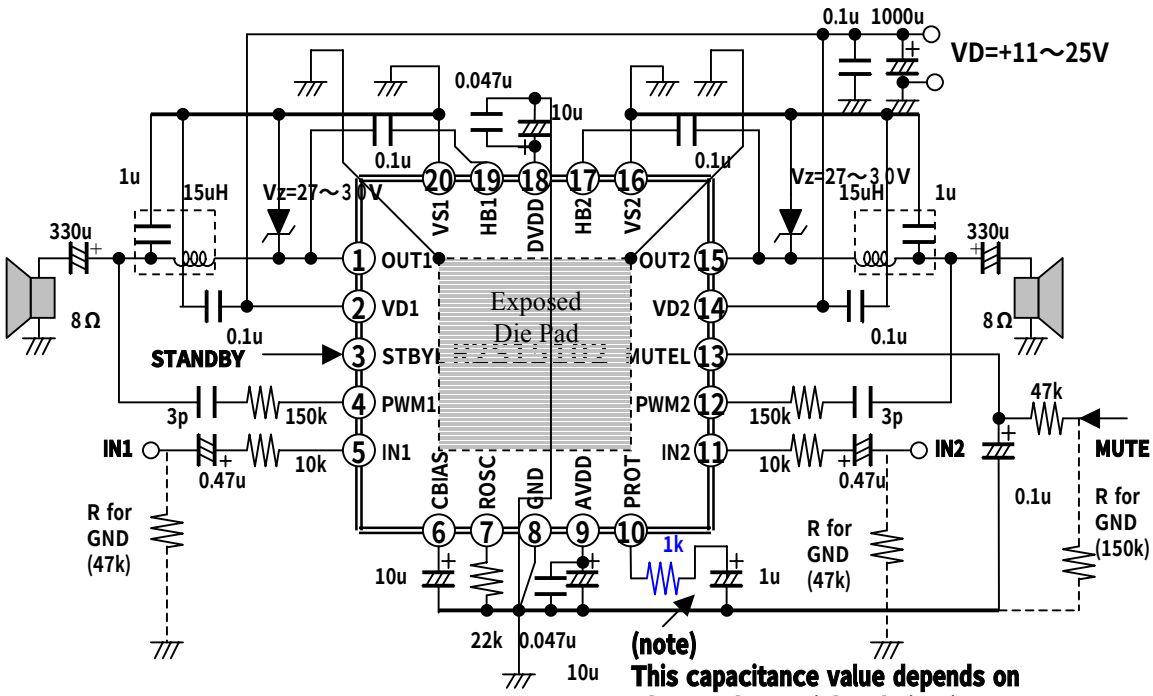


Fig.5 BTL operation mode (20W)

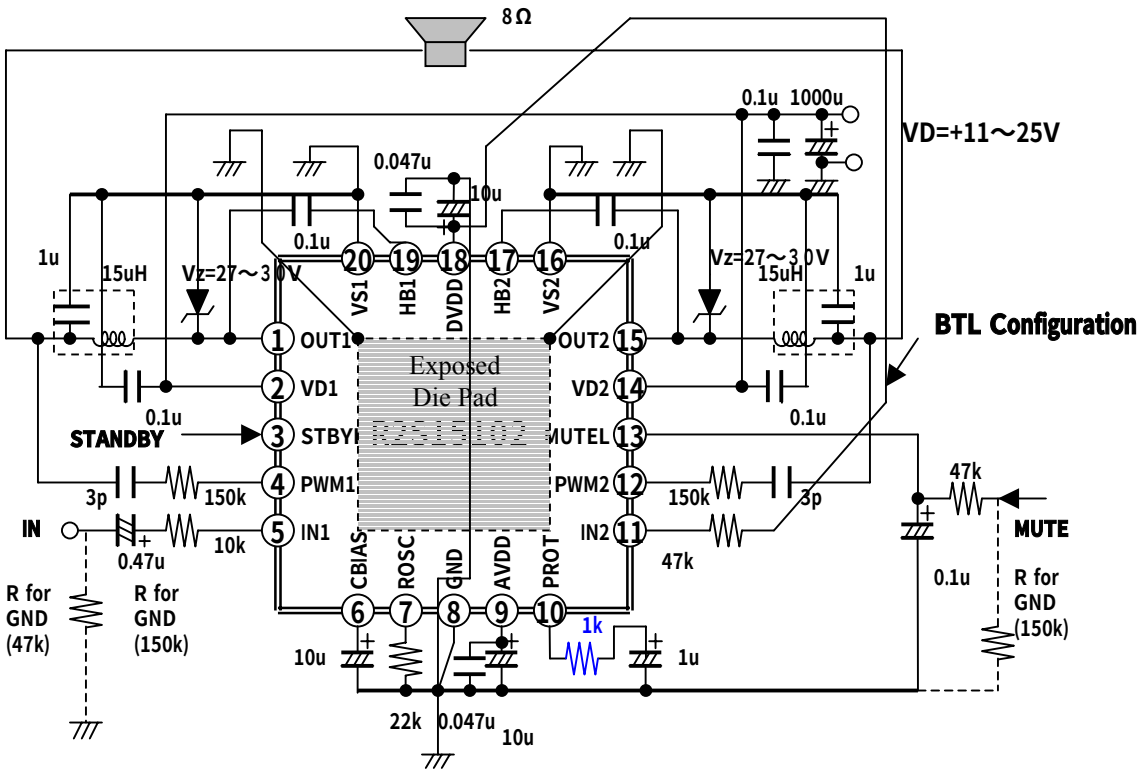


Fig.6 BTL operation mode(20W) with PWM direct input

(note)
"R for GND" 's are for the evaluation only and not needed actually.

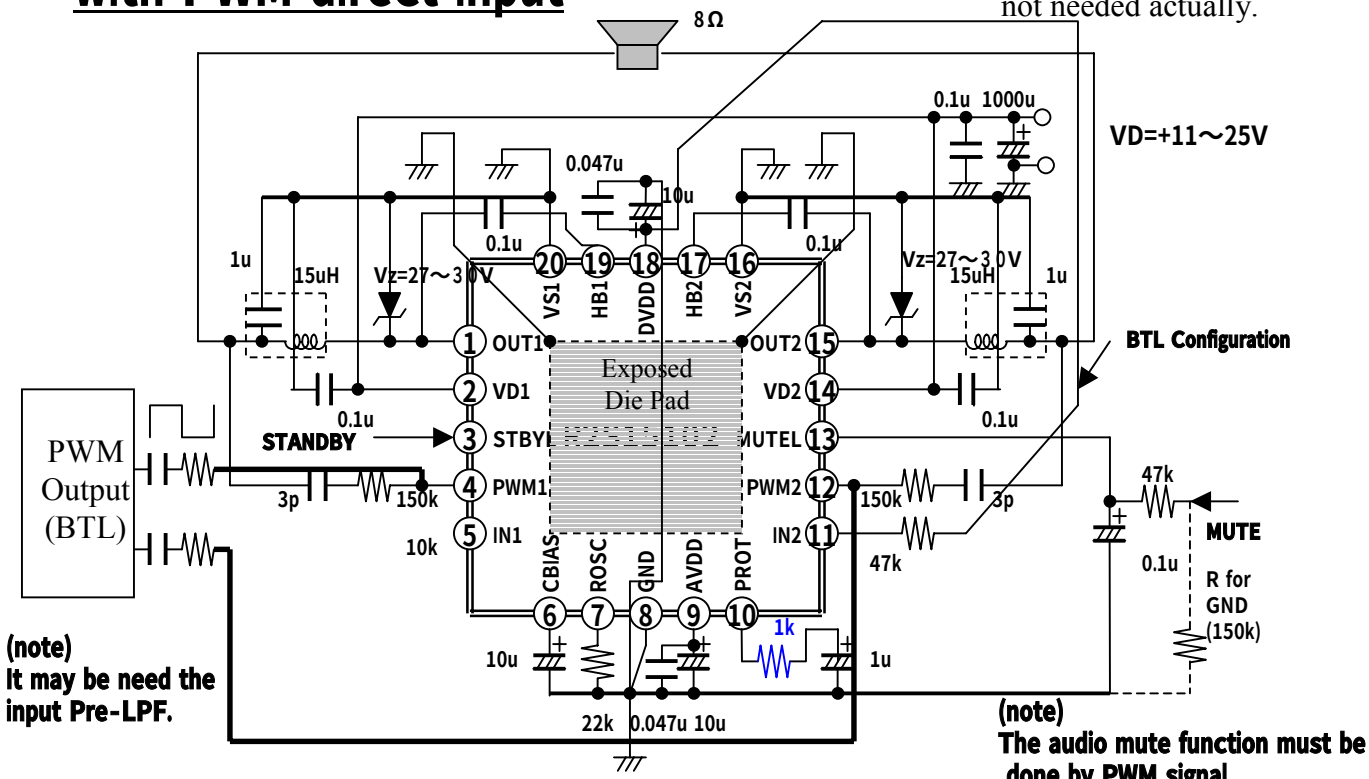
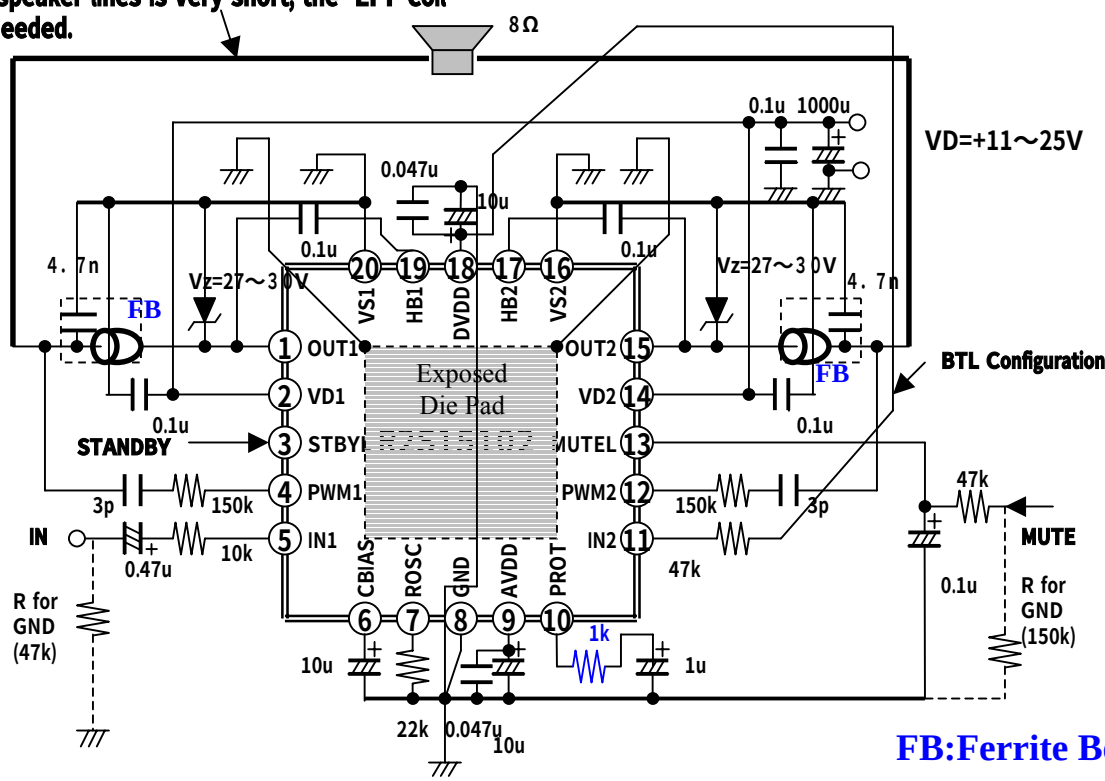


Fig.7 BTL operation mode without output LPF coil

If this speaker lines is very short, the LPF coil is not needed.



WM8776

24-bit, 192kHz Stereo Codec with 5 Channel I/P Multiplexer

DESCRIPTION

The WM8776 is a high performance, stereo audio codec with five channel input selector. The WM8776 is ideal for surround sound processing applications for home hi-fi, DVD-RW and other audio visual equipment.

A stereo 24-bit multi-bit sigma delta ADC is used with a five stereo channel input mixer. Each ADC channel has programmable gain control with automatic level control. Digital audio output word lengths from 16-32 bits and sampling rates from 32kHz to 96kHz are supported.

A stereo 24-bit multi-bit sigma delta DAC is used with digital audio input word lengths from 16-32 bits and sampling rates from 32kHz to 192kHz. The DAC has an input mixer allowing an external analogue signal to be mixed with the DAC signal. There are also Headphone and line outputs, with volume controls for the headphones.

The WM8776 supports fully independent sample rates for the ADC and DAC. The audio data interface supports I^2S, left justified, right justified and DSP formats.

The device is controlled in software via a 2 or 3 wire serial interface, selected by the MODE pin, which provides access to all features including channel selection, volume controls, mutes, and de-emphasis facilities.

The device is available in a 48-pin TQFP package.

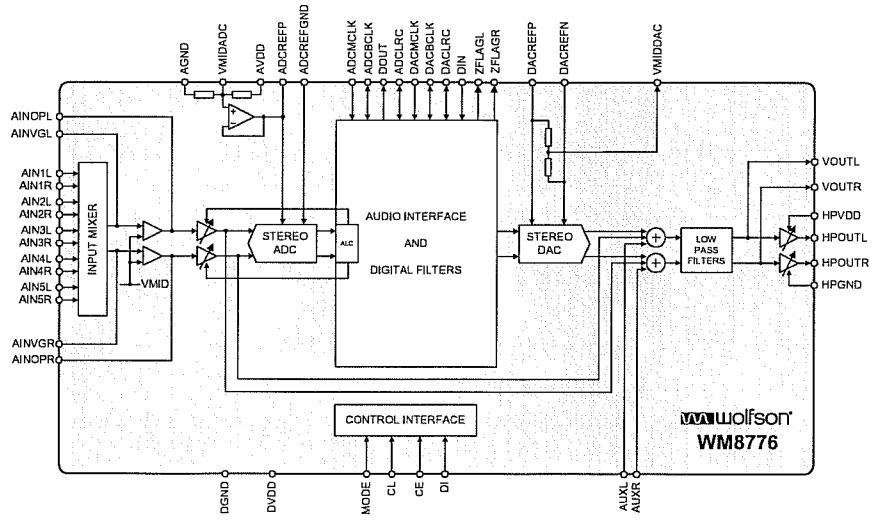
FEATURES

- Audio Performance
  - 108dB SNR ('A' weighted @ 48kHz) DAC
  - 102dB SNR ('A' weighted @ 48kHz) ADC
- DAC Sampling Frequency: 32kHz – 192kHz
- ADC Sampling Frequency: 32kHz – 96kHz
- Five stereo ADC inputs with analogue gain adjust from +24dB to –21dB in 0.5dB steps
- Programmable Limiter or Automatic Level Control (ALC)
- Stereo DAC with independent analogue and digital volume controls
- Stereo Headphone and Line Output
- 3-Wire SPI Compatible or 2-Wire Software Serial Control Interface
- Master or Slave Clocking Mode
- Programmable Audio Data Interface Modes
  - I^2S, Left, Right Justified or DSP
  - 16/20/24/32 bit Word Lengths
- Analogue Bypass Path Feature
- Selectable AUX input to the volume controls
- 2.7V to 5.5V Analogue, 2.7V to 3.6V Digital supply Operation

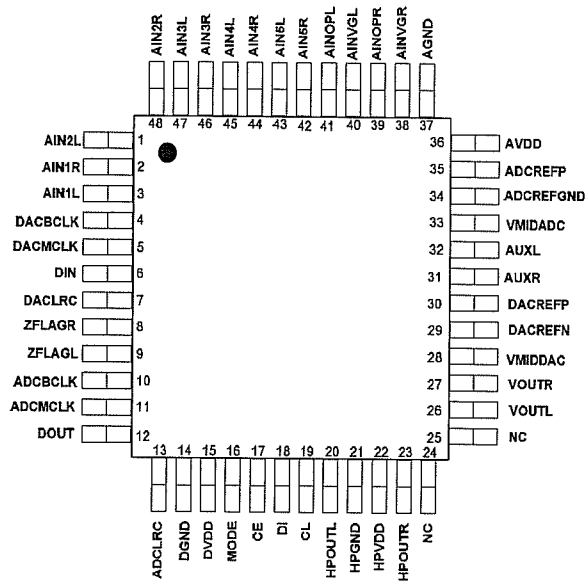
APPLICATIONS

- Surround Sound AV Processors and Hi-Fi systems
- DVD-RW

BLOCK DIAGRAM



PIN CONFIGURATION



ORDERING INFORMATION

DEVICE	TEMPERATURE RANGE	PACKAGE	MOISTURE SENSITIVITY LEVEL	PEAK SOLDERING TEMPERATURE
WM8776EFT/V	-25 to +85°C	48-pin TQFP	MSL2	240°C
WM8776EFT/RV	-25 to +85°C	48-pin TQFP (tape and reel)	MSL2	240°C
WM8776SEFT/V	-25 to +85°C	48-pin TQFP (lead free)	MSL2	260°C
WM8776SEFT/RV	-25 to +85°C	48-pin TQFP (lead free, tape and reel)	MSL2	260°C

Note:

Reel quantity = 2,200

PIN DESCRIPTION

PIN	NAME	TYPE	DESCRIPTION
1	AIN2L	Analogue Input	Channel 2 left input multiplexor virtual ground
2	AIN1R	Analogue Input	Channel 1 right input multiplexor virtual ground
3	AIN1L	Analogue Input	Channel 1 left input multiplexor virtual ground
4	DACBCLK	Digital input/output	DAC audio interface bit clock
5	DACMCLK	Digital input	Master DAC clock; 256, 384, 512 or 768fs (fs = word clock frequency)
6	DIN	Digital Input	DAC data input
7	DACLRC	Digital input/output	DAC left/right word clock
8	ZFLAGR	Open Drain output	DAC Right Zero Flag output (external pull-up resistor required)
9	ZFLAGL	Open Drain output	DAC Left Zero Flag output (external pull-up resistor required)
10	ADCBCLK	Digital input/output	ADC audio interface bit clock
11	ADCMCLK	Digital input	ADC audio interface master clock
12	DOUT	Digital output	ADC data output
13	ADCLRC	Digital input/output	ADC left/right word clock
14	DGND	Supply	Digital negative supply
15	DVDD	Supply	Digital positive supply
16	MODE	Digital input	Control interface mode select (5V tolerant)
17	CE	Digital input	Serial interface Latch signal (5V tolerant)
18	DI	Digital input	Serial interface data (5V tolerant)
19	CL	Digital input	Serial interface clock (5V tolerant)
20	HPOUTL	Analogue Output	Headphone left channel output
21	HPGND	Supply	Headphone negative supply
22	HPVDD	Supply	Headphone positive supply
23	HPOUTR	Analogue Output	Headphone right channel output
24	NC	Not bonded	
25	NC	Not bonded	
26	VOUTL	Analogue output	DAC channel left output
27	VOUTR	Analogue output	DAC channel right output
28	VMIDDAC	Analogue output	DAC midrail decoupling pin ; 10uF external decoupling
29	DACREFN	Analogue input	DAC negative reference input
30	DACREFP	Analogue input	DAC positive reference input
31	AUXR	Analogue input	DAC mixer right channel input
32	AUXL	Analogue input	DAC mixer left channel input
33	VMIDADC	Analogue Output	ADC midrail divider decoupling pin; 10uF external decoupling
34	ADCREFGND	Supply	ADC negative supply and substrate connection
35	ADCREFP	Analogue Output	ADC positive reference decoupling pin; 10uF external decoupling
36	AVDD	Supply	Analogue positive supply
37	AGND	Supply	Analogue negative supply and subVstrate connection
38	AINVGR	Analogue Input	Right channel multiplexor virtual ground
39	AINOPR	Analogue Output	Right channel multiplexor output
40	AINVGL	Analogue Input	Left channel multiplexor virtual ground
41	AINOPL	Analogue Output	Left channel multiplexor output
42	AIN5R	Analogue Input	Channel 5 right input multiplexor virtual ground
43	AIN5L	Analogue Input	Channel 5 left input multiplexor virtual ground
44	AIN4R	Analogue Input	Channel 4 right input multiplexor virtual ground
45	AIN4L	Analogue Input	Channel 4 left input multiplexor virtual ground
46	AIN3R	Analogue Input	Channel 3 right input multiplexor virtual ground
47	AIN3L	Analogue Input	Channel 3 left input multiplexor virtual ground
48	AIN2R	Analogue Input	Channel 2 right input multiplexor virtual ground

Note : Digital input pins have Schmitt trigger input buffers and pins 16, 17, 18 and 19 are 5V tolerant.

ABSOLUTE MAXIMUM RATINGS

Absolute Maximum Ratings are stress ratings only. Permanent damage to the device may be caused by continuously operating at or beyond these limits. Device functional operating limits and guaranteed performance specifications are given under Electrical Characteristics at the test conditions specified.

ESD Sensitive Device. This device is manufactured on a CMOS process. It is therefore generically susceptible to damage from excessive static voltages. Proper ESD precautions must be taken during handling and storage of this device.

Wolfson tests its package types according to IPC/JEDEC J-STD-020B for Moisture Sensitivity to determine acceptable storage conditions prior to surface mount assembly. These levels are:

MSL1 = unlimited floor life at <30°C / 85% Relative Humidity. Not normally stored in moisture barrier bag.
MSL2 = out of bag storage for 1 year at <30°C / 60% Relative Humidity. Supplied in moisture barrier bag.
MSL3 = out of bag storage for 168 hours at <30°C / 60% Relative Humidity. Supplied in moisture barrier bag.

CONDITION	MIN	MAX
Digital supply voltage	-0.3V	+3.63V
Analogue supply voltage	-0.3V	+7V
Voltage range digital inputs (DI, CL, CE and MODE)	DGND -0.3V	+7V
Voltage range digital inputs (MCLK, DIN, ADCLRC, DACLRC, ADCBCLK and DACBCLK)	DGND -0.3V	DVDD + 0.3V
Voltage range analogue inputs	AGND -0.3V	AVDD +0.3V
Master Clock Frequency		37MHz
Operating temperature range, T_A	-25°C	+85°C
Storage temperature	-65°C	+150°C

Notes:

1. Analogue and digital grounds must always be within 0.3V of each other.

RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Digital supply range	DVDD		2.7		3.6	V
Analogue supply range	AVDD, HPVDD, DACREFP		2.7		5.5	V
Ground	AGND, DGND, DACREFN, ADCREFGND			0		V
Difference DGND to AGND			-0.3	0	+0.3	V

Note: digital supply DVDD must never be more than 0.3V greater than AVDD.

ELECTRICAL CHARACTERISTICS

Test Conditions

AVDD = 5V, DVDD = 3.3V, AGND = 0V, DGND = 0V, T_A = +25°C, fs = 48kHz, MCLK = 256fs unless otherwise stated.

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Digital Logic Levels (TTL Levels)						
Input LOW level	V_{IL}				0.8	V
Input HIGH level	V_{IH}		2.0			V
Output LOW	V_{OL}	I_{OL}=1mA			0.1 x DVDD	V
Output HIGH	V_{OH}	I_{OH}=1mA	0.9 x DVDD			V
Analogue Reference Levels						
Reference voltage	V_{VMID}			AVDD/2		V
Potential divider resistance	R_{VMID}			50k		Ω
DAC Performance (Load = 10k Ω, 50pF)						
0dBFs Full scale output voltage				1.0 x AVDD/5		Vrms
SNR (Note 1,2)		A-weighted, @ fs = 48kHz		108		dB
SNR (Note 1,2)		A-weighted @ fs = 96kHz		108		dB
Dynamic Range (Note 2)	DNR	A-weighted, -60dB full scale input		108		dB
Total Harmonic Distortion (THD)		1kHz, 0dBFs		-97	-90	dB
DAC channel separation				100		dB
Power Supply Rejection Ratio	PSRR	1kHz 100mVpp		50		dB
		20Hz to 20kHz 100mVpp		45		dB
Headphone Buffer						
Maximum Output voltage				0.9		Vrms
Max Output Power (Note 4)	P_o	R_L = 32 Ω		25		mW
		R_L = 16 Ω		50		mW
SNR (Note 1,2)		A-weighted	85	92		dB
Headphone analogue Volume Gain Step Size			0.5	1	1.5	dB
Headphone analogue Volume Gain Range		1kHz Input	-73		+6	dB
Headphone analogue Volume Mute Attenuation		1kHz Input, 0dB gain		100		dB
Total Harmonic Distortion +Noise	THD+N	1kHz, R_L = 32Ω @ P_o = 10mW rms		-80 0.01	-60 0.1	dB %
		1kHz, R_L = 32Ω @ P_o = 20mW rms		-77 0.014	-40 1.0	dB %
Power Supply Rejection Ratio	PSRR	20Hz to 20kHz, without supply decoupling		-40		dB
ADC Performance						
Input Signal Level (0dB)				1.0 x AVDD/5		Vrms
SNR (Note 1,2)		A-weighted, 0dB gain @ fs = 48kHz		102		dB
SNR (Note 1,2)		A-weighted, 0dB gain @ fs = 96kHz 64 x OSR		100		dB
Dynamic Range (note 2)		A-weighted, -60dB full scale input		102		dB
Total Harmonic Distortion (THD)		1kHz, 0dBFs		-90	-80	DB

Test Conditions

AVDD = 5V, DVDD = 3.3V, AGND = 0V, DGND = 0V, T_A = +25°C, fs = 48kHz, MCLK = 256fs unless otherwise stated.

		1kHz, -3dBFs		-95	-85	dB
ADC Channel Separation		1kHz Input		90		dB
Programmable Gain Step Size			0.25	0.5	0.75	dB
Programmable Gain Range (Analogue)		1kHz Input	-21		+24	dB
Programmable Gain Range (Digital)		1kHz Input	-103		-21.5	dB
Mute Attenuation (Note 6)		1kHz Input, 0dB gain		76		dB
Power Supply Rejection Ratio	PSRR	1kHz 100mVpp		50		dB
		20Hz to 20kHz 100mVpp		45		dB
Analogue input (AIN) to Analogue output (VOUT) (Load=10k Ω, 50pF, gain = 0dB) Bypass Mode						
0dB Full scale output voltage				1.0 x AVDD/5		Vrms
SNR (Note 1)			90	100		dB
THD		1kHz, 0dB		-90		dB
		1kHz, -3dB		-95		dB
Power Supply Rejection Ratio	PSRR	1kHz 100mVpp		50		dB
		20Hz to 20kHz 100mVpp		45		dB
Mute Attenuation		1kHz, 0dB		100		dB
Supply Current						
Analogue supply current		AVDD = 5V		48		mA
Digital supply current		DVDD = 3.3V		8		mA

Notes:

1. Ratio of output level with 1kHz full scale input, to the output level with all zeros into the digital input, measured 'A' weighted.
2. All performance measurements done with 20kHz low pass filter, and where noted an A-weight filter. Failure to use such a filter will result in higher THD+N and lower SNR and Dynamic Range readings than are found in the Electrical Characteristics. The low pass filter removes out of band noise; although it is not audible it may affect dynamic specification values.
3. VMID decoupled with 10uF and 0.1uF capacitors (smaller values may result in reduced performance).
4. Harmonic distortion on the headphone output decreases with output power.
5. All performance measurement done using certain timings conditions (Please refer to section 'Digital Audio Interface').
6. A better MUTE Attenuation can be achieved if the ADC gain is set to minimum.

TERMINOLOGY

1. Signal-to-noise ratio (dB) - SNR is a measure of the difference in level between the full scale output and the output with no signal applied. (No Auto-zero or Automute function is employed in achieving these results).
2. Dynamic range (dB) - DNR is a measure of the difference between the highest and lowest portions of a signal. Normally a THD+N measurement at 60dB below full scale. The measured signal is then corrected by adding the 60dB to it. (e.g. THD+N @ -60dB= -32dB, DR= 92dB).
3. THD+N (dB) - THD+N is a ratio, of the rms values, of (Noise + Distortion)/Signal.
4. Stop band attenuation (dB) - Is the degree to which the frequency spectrum is attenuated (outside audio band).
5. Channel Separation (dB) - Also known as Cross-Talk. This is a measure of the amount one channel is isolated from the other. Normally measured by sending a full scale signal down one channel and measuring the other.
6. Pass-Band Ripple - Any variation of the frequency response in the pass-band region.

TFT LCD Approval Specification

MODEL NO.: V320B1 - L01

Customer: _____

Approved by: _____

Note:

LCD TV Head Division	

QRA Dept.	TVHD / PDD		
	DDIII	DDII	DDI
Approval	Approval	Approval	Approval

LCD TV Marketing and Product Management Division	

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11. MECHANICAL CHARACTERISTICS ----------

REVISION HISTORY

Version	Date	Page (New)	Section	Description
Ver 1.0	July 12,'04	All	All	Preliminary Specification was first issued.
		All	All	Approval Specification was first issued.
Ver 2.0	Sep. 15 ,'04	9	3.2.2	Input Voltage Min.：21.6 → 22.8 Max.：26.4 → 25.2 Input Ripple Noise Note：V_{BL}=21.6V → V_{BL}=22.8V
		12	4.1	Inverter connector CN1：S10B-PH-SM3-TB(JST) → S10B-PH-SM3-TB(D)(LF)(JST) CN2：S12B-PH-SM3-TB(JST) → S12B-PH-SM3-TB(D)(LF)(JST) CN3-CN10:SM02 (8.0)B-BHS-1-TB(JST) → SM02 (8.0)B-BHS-1-TB(LF)(JST) CN11: S2B-ZR-SM3A-TF (JST) → S2B-ZR-SM3A-TF (D)(LF)(JST)
		14	5.2	Inverter connectors are modified as Section 4.1. The Drawing is modified to a detail one.
		15	5.3	Inverter connectors are modified as Section 4.1.
		22	7.1	Oscillating Frequency (Inverter)：62 ± 3 → 62.5 ± 3 Color Chromaticity ： Min Typ Max Rx：0.618 → 0.621 0.648 → 0.651 0.678 → 0.681 Gx：0.242 → 0.239 0.272 → 0.269 0.302 → 0.299 Gy：0.576 → 0.567 0.606 → 0.597 0.636 → 0.627 By：0.044 → 0.036 0.074 → 0.066 0.104 → 0.096
		30	11	The Drawing is modified.
		31	11	The Drawing is modified.
Ver 2.1	Dec. 20 ,'04	4	1.2	Contrast Ratio：800:1 →1000:1
		4	1.5	Weight：Min 5900→5700, Typ. 6100→5900, Max. 6300→6100
		7	3.1	Rush Current：Max. 1.7→3
		13	5.1	CNF1 Connector Pin Assignment：Pin3 is modified.
		17	5.5	LVDS INTERFACE is modified.
		22	7.2	Contrast Ratio： Min.600 → 800,Typ. 800→1000 Response Time is modified. Color Chromaticity ： Min Typ Max Rx：0.621 → 0.622 0.651 → 0.652 0.681 → 0.682 Gx：0.239 → 0.240 0.269 → 0.270 0.299 → 0.300 Gy：0.567 → 0.559 0.597 → 0.589 0.627 → 0.619 Bx：0.111 → 0.036 0.141 → 0.066 0.171 → 0.096 By：0.036 → 0.038 0.066 → 0.068 0.096 → 0.098
		23	7.2	Notes are modified.
		30	11	The Drawing is modified.
		31	11	The Drawing is modified.
Ver3.0	Jun. 28, '05	5	1.2	FEATURES are added - Low color shift function option - Color Reproduction (Nature color)
			1.4	GENERAL SPECIFICATI0NS Surface Treatment : Hardness : 3H, Haze : 40% Anti-reflective coating < 2% reflection → Hardness : 3H, Anti-Glary
		14	5.1	TFT LCD MODULE : Modify CNF1 Connector Pin Assignment Pin No. Symbol Description 7 ODSEL → LCS Over drive look up section → Low color shift

				Add Note (6) Enable Low color shift function.
		16	5.3	INVERTER UNIT : Modify CN2(Header) Pin No. Symbol Description 5 NC → GND NC → Ground
		18	5.5	LVDS INTERFACE : Revised Notes(1) RSVD(reserved)pins on the transmitter shall be “H” or(“L” or OPEN)
		20	6.1	INPUT SIGNAL TIMING SPECIFICATIONS Add LVDS Receiver Clock : Input cycle to cycle jitter : max 200 ps
		28, 29	9.2	PACKING METHOD : Modify Figures 9-1 and 9-2
Ver3.2	Apr. 25,2006	29	9.2	PACKING METHOD : Modify Figures 9-2

1. GENERAL DESCRIPTION

1.1 OVERVIEW

V320B1- L01 is a 32” TFT Liquid Crystal Display module with 16-CCFL Backlight unit and 1ch-LVDS interface. This module supports 1366 x 768 WXGA format and can display true 16.7M colors (8-bit/color). The inverter module for backlight is built-in.

1.2 FEATURES

-High brightness (550 nits)

- High contrast ratio (1000:1)
- Fast response time (8ms)
- High color saturation NTSC 75%
- WXGA (1366 x 768 pixels) resolution
- DE (Data Enable) only mode
- LVDS (Low Voltage Differential Signaling) interface
- Optimized response time for 50/60 Hz frame rate
- Ultra wide viewing angle : 176(H)/176(V) (CR>20) Super MVA technology
- 180 degree rotation display option
- Low color shift function option
- Color Reproduction (Nature color)

1.3 APPLICATION

- TFT LCD TVs

1.4 GENERAL SPECIFICATI0NS

Item	Specification	Unit	Note
Active Area	708.954(H) x 398.592 (V) (32.02” diagonal)	mm	(1)
Bezel Opening Area	714.96 (H) x 404.6 (V)	mm	
Driver Element	a-si TFT active matrix	-	
Pixel Number	1366 x R.G.B. x 768	pixel	
Pixel Pitch (Sub Pixel)	0.1730 (H) x 0.5190 (V)	mm	
Pixel Arrangement	RGB vertical stripe	-	
Display Colors	16.7M	color	
Display Operation Mode	Transmissive mode / Normally black	-	
Surface Treatment	Hardness : 3H, Anti-Glary	-	

1.5 MECHANICAL SPECIFICATIONS

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal(H)	759.25	760	760.75	mm	
	Vertical(V)	449.25	450	450.75	mm	
	Depth(D)	37.45	37.95	38.75	mm	To PCB cover
	Depth(D)	46.53	47.53	48.53	mm	To inverter cover
Weight		5700	5900	6100	g	

Note (1) Please refer to the attached drawings for more information of front and back outline dimensions.

2. ABSOLUTE MAXIMUM RATINGS

2.1 ABSOLUTE RATINGS OF ENVIRONMENT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Storage Temperature	T_{ST}	-20	+60	ºC	(1)
Operating Ambient Temperature	T_{OP}	0	+50	ºC	(1), (2)
Shock (Non-Operating)	S_{NOP}	-	50	G	(3), (5)
Vibration (Non-Operating)	V_{NOP}	-	1.0	G	(4), (5)

Note (1) Temperature and relative humidity range is shown in the figure below.

(a) 90 %RH Max. (Ta ≦ 40 ºC).

(b) Wet-bulb temperature should be 39 ºC Max. (Ta > 40 ºC).

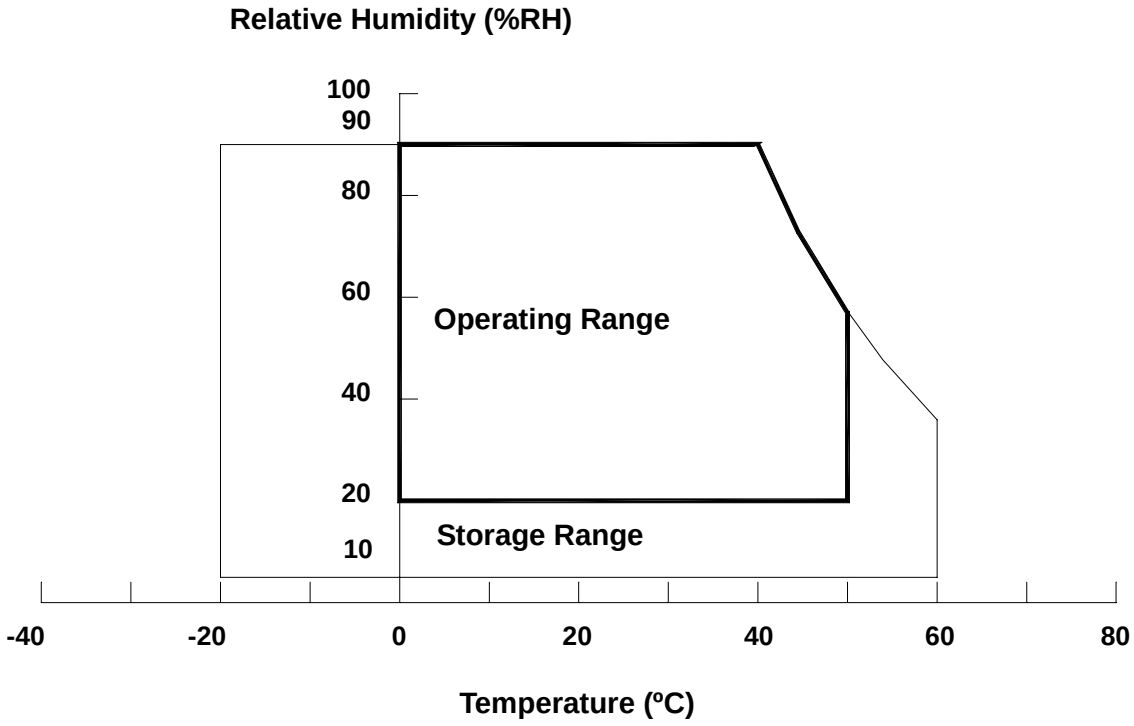
(c) No condensation.

Note (2) The maximum operating temperature is based on the test condition that the surface temperature of display area is less than or equal to 60 ºC with LCD module alone in a temperature controlled chamber. Thermal management should be considered in final product design to prevent the surface temperature of display area from being over 60 ºC. The range of operating temperature may degrade in case of improper thermal management in final product design.

Note (3) 11 ms, half sine wave, 1 time for ± X, ± Y, ± Z.

Note (4) 10 ~ 200 Hz, 10 min, 1 time each X, Y, Z.

Note (5) At testing Vibration and Shock, the fixture in holding the module has to be hard and rigid enough so that the module would not be twisted or bent by the fixture.



2.2 ELECTRICAL ABSOLUTE RATINGS

2.2.1 TFT LCD MODULE

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Power Supply Voltage	Vcc	-0.3	6.0	V	(1)
Input Signal Voltage	V_{IN}	-0.3	3.6	V	

2.2.2 BACKLIGHT UNIT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Lamp Voltage	V_W	—	3000	V_{RMS}	
Power Supply Voltage	V_{BL}	0	30	V	(1)
Control Signal Level	—	-0.3	7	V	(1), (3)

Note (1) Permanent damage to the device may occur if maximum values are exceeded. Functional operation should be restricted to the conditions described under normal operating conditions.

Note (2) No moisture condensation or freezing.

Note (3) The control signals includes Backlight On/Off Control, Internal PWM Control, External PWM Control and Internal/External PWM Selection.

3. ELECTRICAL CHARACTERISTICS

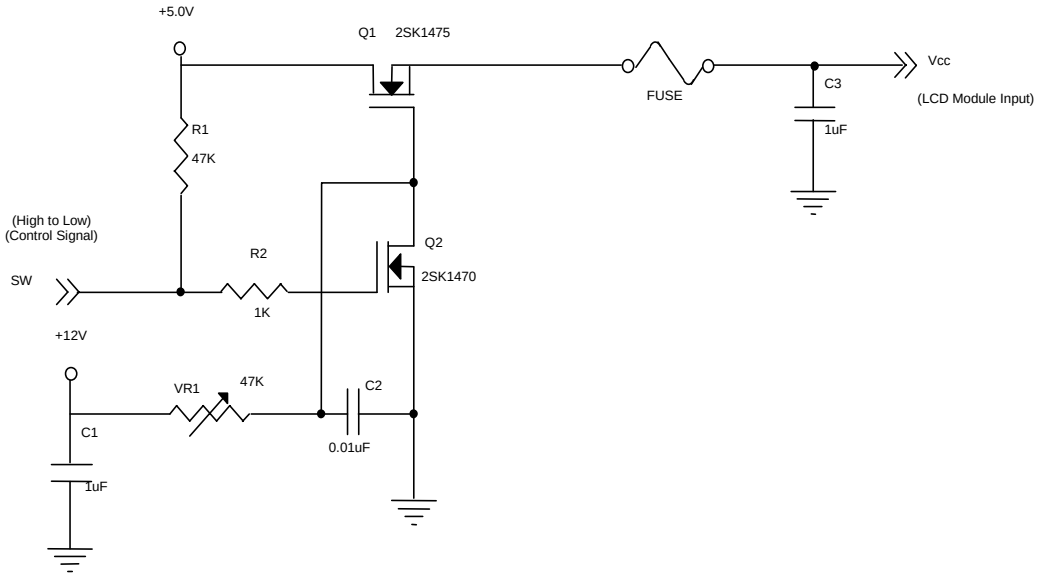
3.1 TFT LCD MODULE

Ta = 25 ± 2 ºC

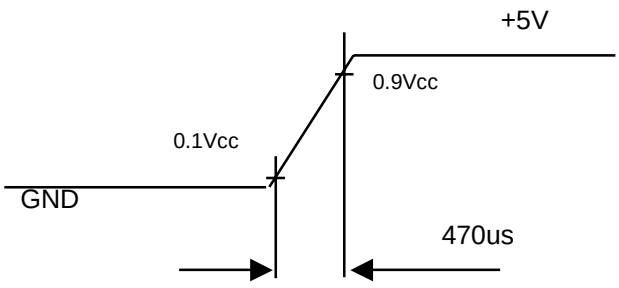
Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Power Supply Voltage		V_{CC}	4.5	5.0	5.5	V	(1)
Power Supply Ripple Voltage		V_{RP}	-	-	100	mV	
Rush Current		I_{RUSH}	-	-	3.0	A	(2)
Power Supply Current	White	I_{CC}	-	1.48	-	A	(3)
	Black		-	0.85	-	A	
	Vertical Stripe		-	1.23	-	A	
LVDS Interface	Differential Input High Threshold Voltage	V_{LVTH}	-	-	+100	mV	
	Differential Input Low Threshold Voltage	V_{LVTL}	-100	-	-	mV	
	Common Input Voltage	V_{LVC}	1.125	1.25	1.375	V	
	Terminating Resistor	R_T	-	100	-	ohm	
CMOS interface	Input High Threshold Voltage	V_{IH}	2.7	-	3.3	V	
	Input Low Threshold Voltage	V_{IL}	0	-	0.7	V	

Note (1) The module should be always operated within above ranges.

Note (2) Measurement Conditions:



Vcc rising time is 470us



Note (3) The specified power supply current is under the conditions at Vcc = 5 V, Ta = 25 ± 2 ºC, f_v = 60 Hz, whereas a power dissipation check pattern below is displayed.

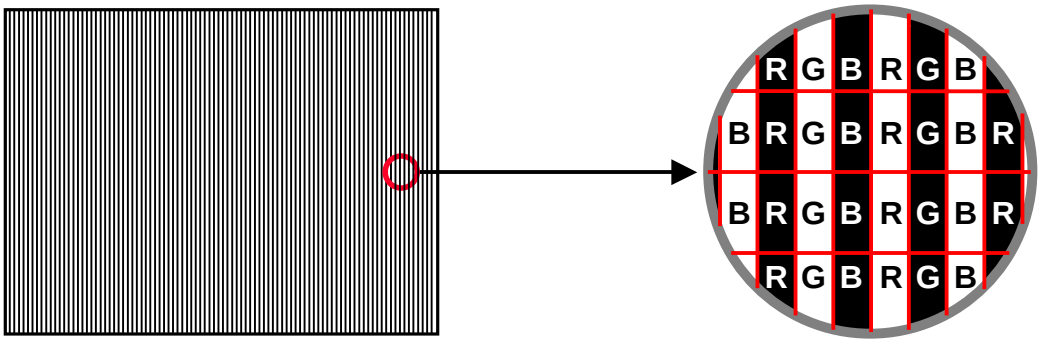
a. White Pattern

Active Area

b. Black Pattern

Active Area

c. Vertical Stripe Pattern



Active Area

3.2 BACKLIGHT INVERTER UNIT

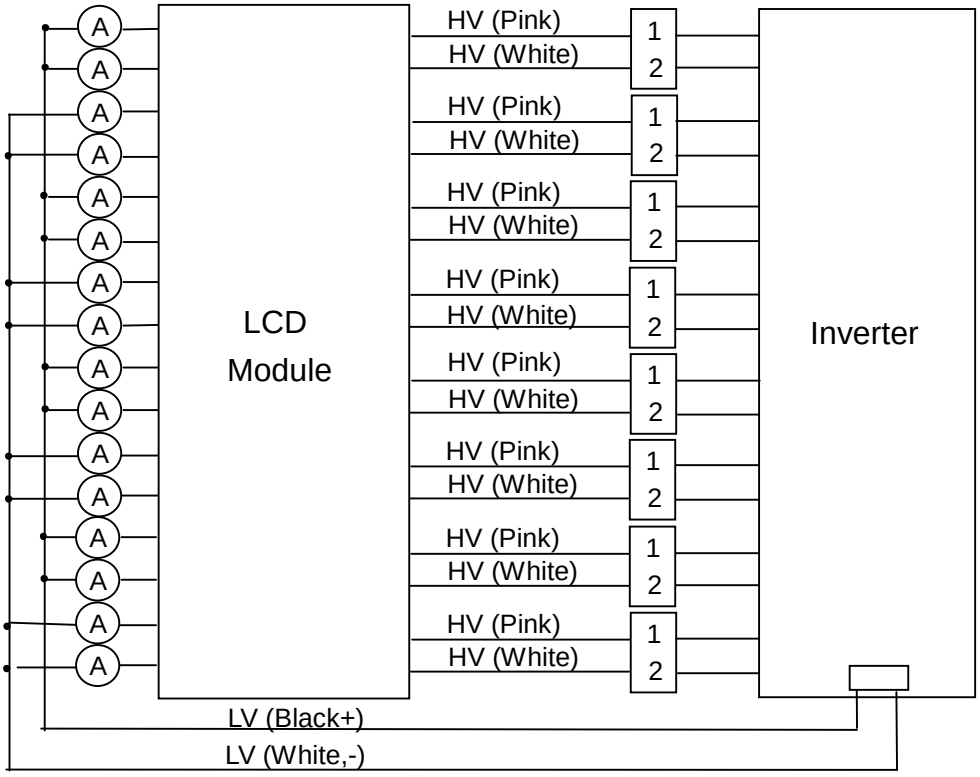
3.2.1 CCFL (Cold Cathode Fluorescent Lamp) CHARACTERISTICS (Ta = 25 ± 2 ºC)

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Lamp Voltage	V_W	-	1280	-	V_{RMS}	I_L = 4.5mA
Lamp Current	I_L	4.0	4.5	5.0	mA_{RMS}	(1)
Lamp Starting Voltage	V_S	-	-	2450	V_{RMS}	(2), Ta = 0 ºC
		-	-	2360	V_{RMS}	(2), Ta = 25 ºC
Operating Frequency	F_O	40	-	70	KHz	(3)
Lamp Life Time	L_{BL}	50,000	60,000	-	Hrs	(4)

3.2.2 INVERTER CHARACTERISTICS (Ta = 25 ± 2 ºC)

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Power Consumption	P_{BL}	-	103	-	W	(5),(6), I_L = 4.5mA
Input Voltage	V_{BL}	22.8	24	25.2	V_{DC}	
Input Current	I_{BL}	-	4.3	-	A	Non Dimming
Input Ripple Noise	-	-	-	500	mV_{P-P}	V_{BL}=22.8V
Backlight Turn on Voltage	V_{BS}	2450	-	-	V_{RMS}	Ta = 0 ºC
		2360	-	-	V_{RMS}	Ta = 25 ºC
Oscillating Frequency	F_W	59.5	62.5	65.5	kHz	
Dimming frequency	F_B	150	160	170	Hz	
Minimum Duty Ratio	D_{MIN}	-	20	-	%	

Note (1) Lamp current is measured by utilizing high frequency current meters as shown below:



Note (2) The lamp starting voltage V_S should be applied to the lamp for more than 1 second under starting up duration. Otherwise the lamp could not be lighted on completed.

Note (3) The lamp frequency may produce interference with horizontal synchronous frequency of the display input signals, and it may result in line flow on the display. In order to avoid interference, the lamp frequency should be detached from the horizontal synchronous frequency and its harmonics as far as possible.

Note (4) The life time of a lamp is defined as when the brightness is larger than 50% of its original value and the effective discharge length is longer than 80% of its original length (Effective discharge length is defined as an area that has equal to or more than 70% brightness compared to the brightness at the center point of lamp.) as the time in which it continues to operate under the

condition at Ta = 25 ±2℃ and I_L = 4.0 ~ 5.0 mA_{RMS}.

Note (5) The power supply capacity should be higher than the total inverter power consumption P_{BL}. Since the pulse width modulation (PWM) mode was applied for backlight dimming, the driving current changed as PWM duty on and off. The transient response of power supply should be considered for the changing loading when inverter dimming.

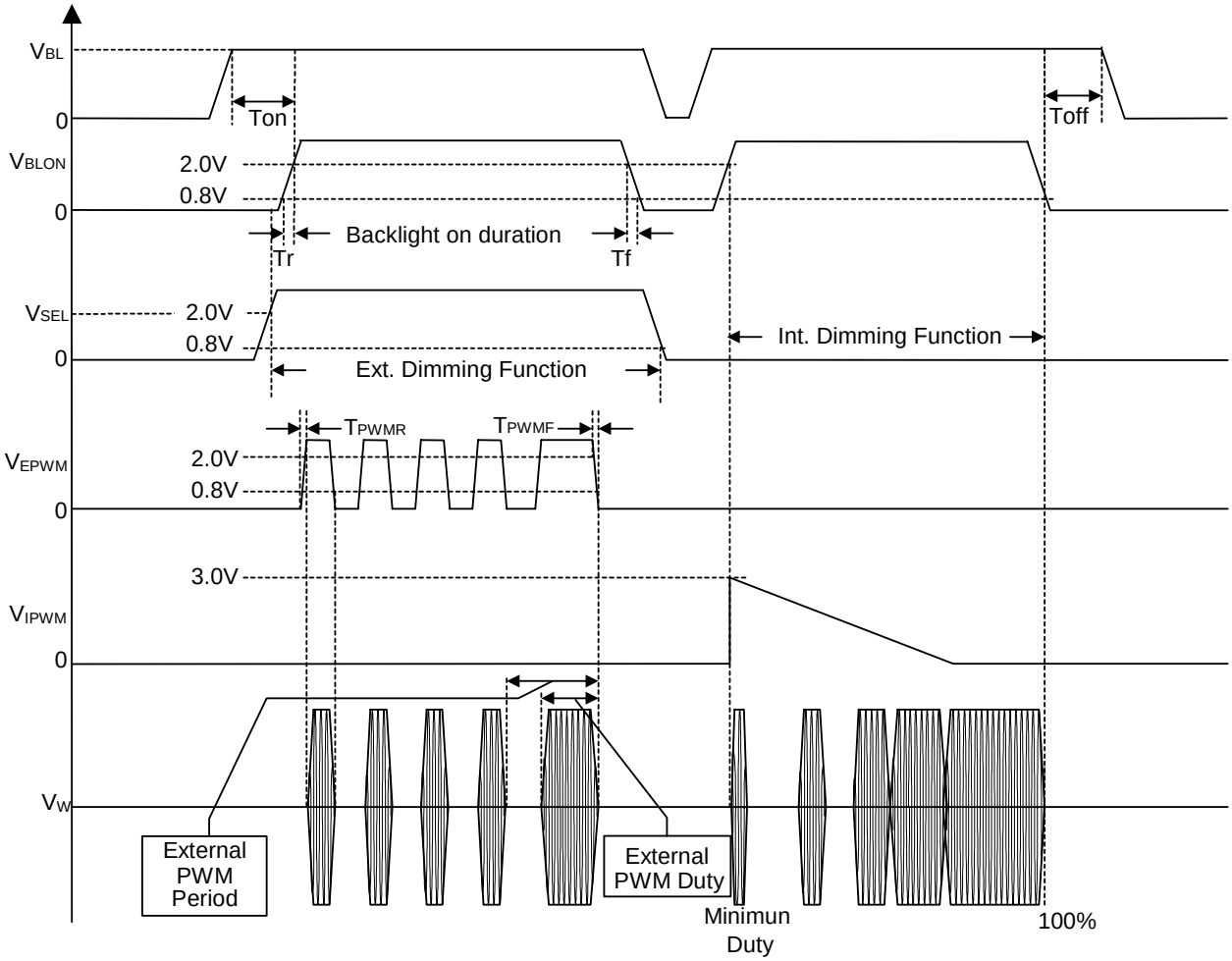
Note (6) To enhance the performance of backlight, the power consumption will increase to 1.5 times of the typical power consumption P_{BL} in the power on stage and 20 seconds later it will return to typical value. Thus, the power source capacity for inverter should be considered to supply the initial power consumption at power on duration.

3.2.3 INVERTER INTERFACE CHARACTERISTICS

Parameter		Symbol	Test Condition	Value			Unit	Note
				Min.	Typ.	Max.		
On/Off Control Voltage	ON	V_{BLON}	—	2.0	—	5.0	V	
	OFF		—	0	—	0.8	V	
Internal/External PWM Select Voltage	HI	V_{SEL}	—	2.0	—	5.0	V	
	LO		—	0	—	0.8	V	
Internal PWM Control Voltage	MAX	V_{IPWM}	V_{SEL} = L	—	—	3.0	V	minimum duty ratio
	MIN			—	0	—	V	maximum duty ratio
External PWM Control Voltage	HI	V_{EPWM}	V_{SEL} = H	2.0	—	5.0	V	duty on
	LO			0	—	0.8	V	duty fff
Control Signal Rising Time		T_r	—	—	—	100	ms	
Control Signal Falling Time		T_f	—	—	—	100	ms	
PWM Signal Rising Time		T_{PWMR}	—	—	—	50	us	
PWM Signal Falling Time		T_{PWMF}	—	—	—	50	us	
Input impedance		R_{IN}	—	1	—	—	MΩ	
BLON Delay Time		T_{on}	—	500	—	—	ms	
BLON Off Time		T_{off}	—	500	—	—	ms	

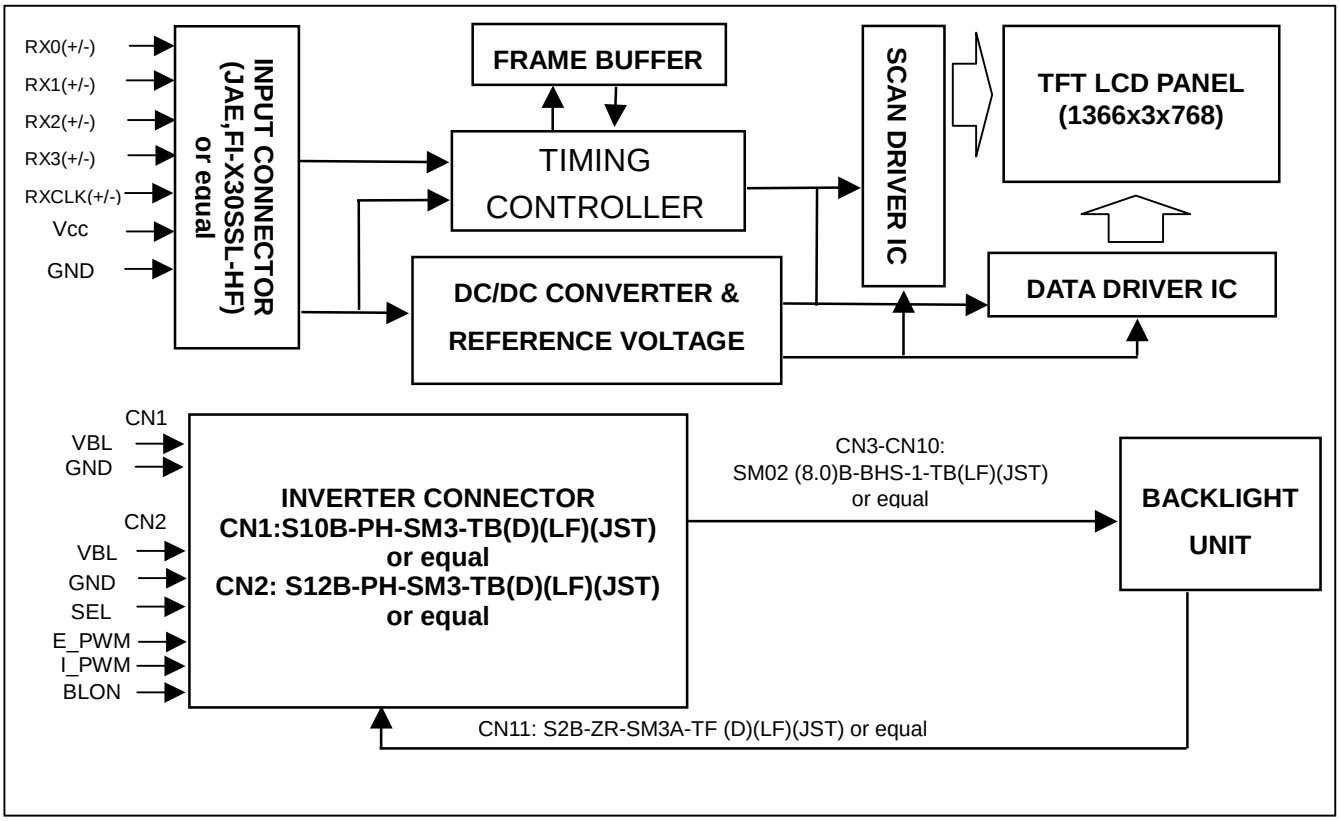
Note (1) The SEL signal should be valid before backlight turns on by BLON signal. It is inhibited to change the internal/external PWM selection (SEL) during backlight turn on period.

Note (2) The power sequence and control signal timing are shown as the following figure.


VBL
0
Ton
Toff
VBLON
2.0V
0.8V
0
Backlight on duration
Tr
Tf
VSEL
2.0V
0.8V
0
Int. Dimming Function
Ext. Dimming Function
TPWMR
TPWMF
VEPWM
2.0V
0.8V
0
3.0V
VIPWM
0
VW
External PWM Period
External PWM Duty
Minimun Duty
100%

4. BLOCK DIAGRAM

4.1 TFT LCD MODULE



5. INTERFACE PIN CONNECTION

5.1 TFT LCD MODULE

CNF1 Connector Pin Assignment

Pin No.	Symbol	Description	Note
1	GND	Ground	
2	RPF	Display Rotation	(3)
3	SELLVDS	Select LVDS data format	(5)
4	NC	No Connection	(2)
5	NC	No Connection	
6	ODSEL	Overdrive Lookup Table Selection	(4)
7	LCS	Low Color Shift	(6)
8	GND	Ground	
9	RX0-	Negative transmission data of pixel 0	
10	RX0+	Positive transmission data of pixel 0	
11	RX1-	Negative transmission data of pixel 1	
12	RX1+	Positive transmission data of pixel 1	
13	RX2-	Negative transmission data of pixel 2	
14	RX2+	Positive transmission data of pixel 2	
15	RXCLK-	Negative of clock	
16	RXCLK+	Positive of clock	
17	RX3-	Negative transmission data of pixel 3	
18	RX3+	Positive transmission data of pixel 3	
19	GND	Ground	
20	GND	Ground	
21	GND	Ground	
22	GND	Ground	
23	GND	Ground	
24	GND	Ground	
25	GND	Ground	
26	VCC	Power supply: +5V	
27	VCC	Power supply: +5V	
28	VCC	Power supply: +5V	
29	VCC	Power supply: +5V	
30	VCC	Power supply: +5V	

Note (1) Connector Part No.: FI-X30SSL-HF(JAE) or compatible

Note (2) Reserved for internal use. Left it open.

Note (3) Low or open: normal display (default), High : display with 180 degree rotation

Note (4) Overdrive lookup table selection. The Overdrive lookup table should be selected in accordance to the frame rate to optimize image quality.

ODSEL	Note
L or Open	Lookup table was optimized for 60 Hz frame rate.
H	Lookup table was optimized for 50 Hz frame rate.

Note (5) Please refer to 5.5 LVDS INTERFACE (Page 18)

Note (6) Enable Low color shift function.

LCS	Note
L or Open	Low color shift off
H	Low color shift on

5.2 BACKLIGHT UNIT

The pin configuration for the housing and leader wire is shown in the table below.

CN3-CN10 (Housing): BHR-03VS-1(JST) or equivalent

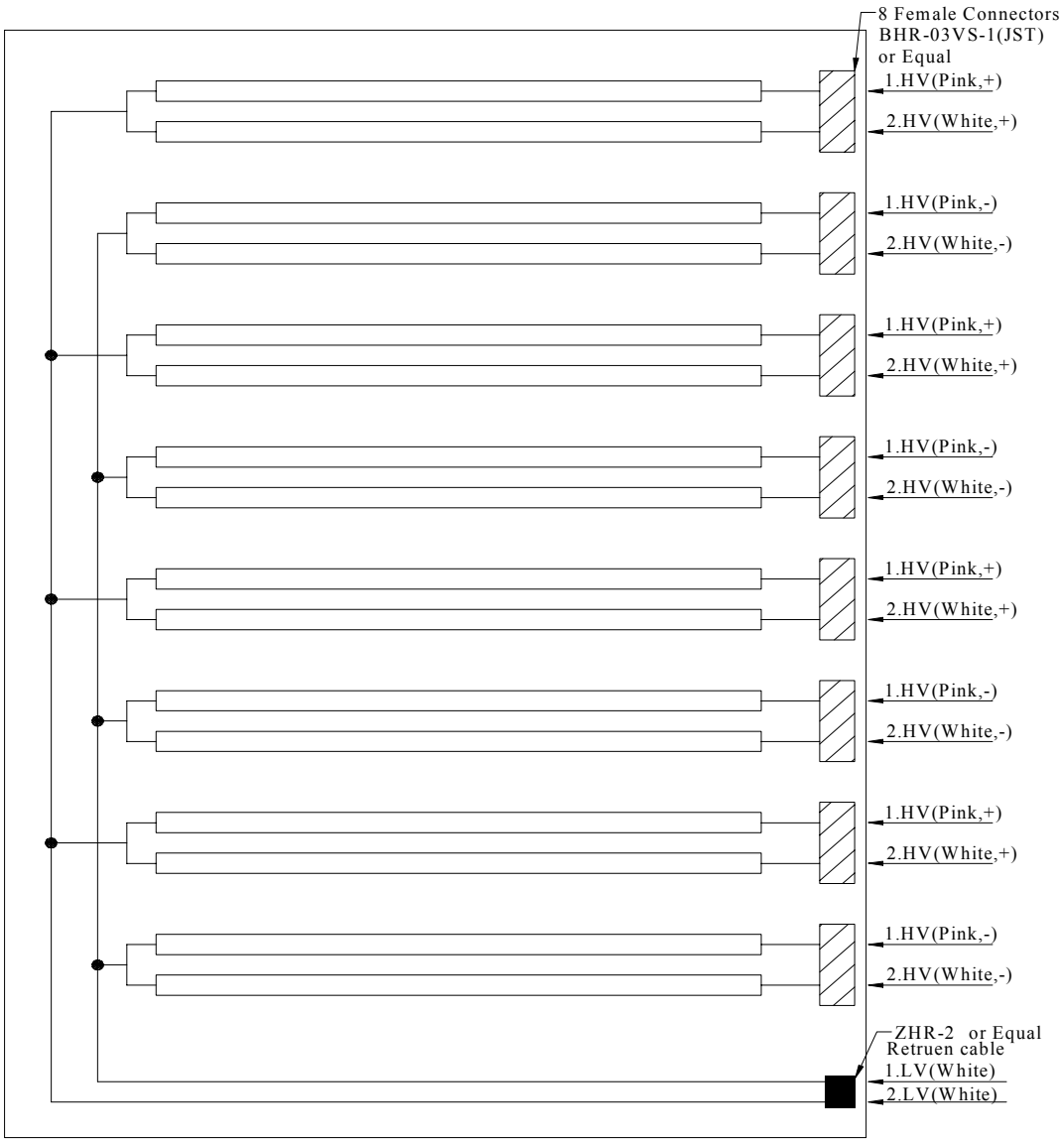
Pin No.	Symbol	Description	Wire Color
1	HV	High Voltage	Pink
2	HV	High Voltage	White

Note (1) The backlight interface housing for high voltage side is a model BHR-03VS-1, manufactured by JST or equivalent. The mating header on inverter part number is SM02(8.0)B-BHS-1-TB(LF).

CN11 (Housing): ZHR-2 (JST) or equivalent

Pin No.	Symbol	Description	Wire Color
1	LV	Low Voltage (+)	Black
2	LV	Low Voltage (-)	White

Note (2) The backlight interface housing and return cable for low voltage side is a model ZHR-2 , manufactured by JST or equivalent. The mating header on inverter part number is S2B-ZR-SM3A-TF(D)(LF) or equivalent.



5.3 INVERTER UNIT

CN1(Header):S10B-PH-SM3-TB(D)(LF)(JST) or equivalent.

Pin No.	Symbol	Description
1	VBL	+24V Power input
2		
3		
4		
5		
6	GND	Ground
7		
8		
9		
10		

CN2(Header): S12B-PH-SM3-TB(D)(LF)(JST) or equivalent..

Pin No.	Symbol	Description
1	VBL	+24V Power input
2		
3		
4		
5	GND	Ground
6		
7		
8		
9	SEL	Internal/external PWM selection High : external dimming Low : internal dimming
10	E_PWM	External PWM control signal E_PWM should be connected to low when internal PWM was selected (SEL = low).
11	I_PWM	Internal PWM control signal I_PWM should be connected to ground when external PWM was selected (SEL = high).
12	BLON	Backlight on/off control

CN3-CN10(Header): SM02(8.0)B-BHS-1-TB(LF)(JST) or equivalent.

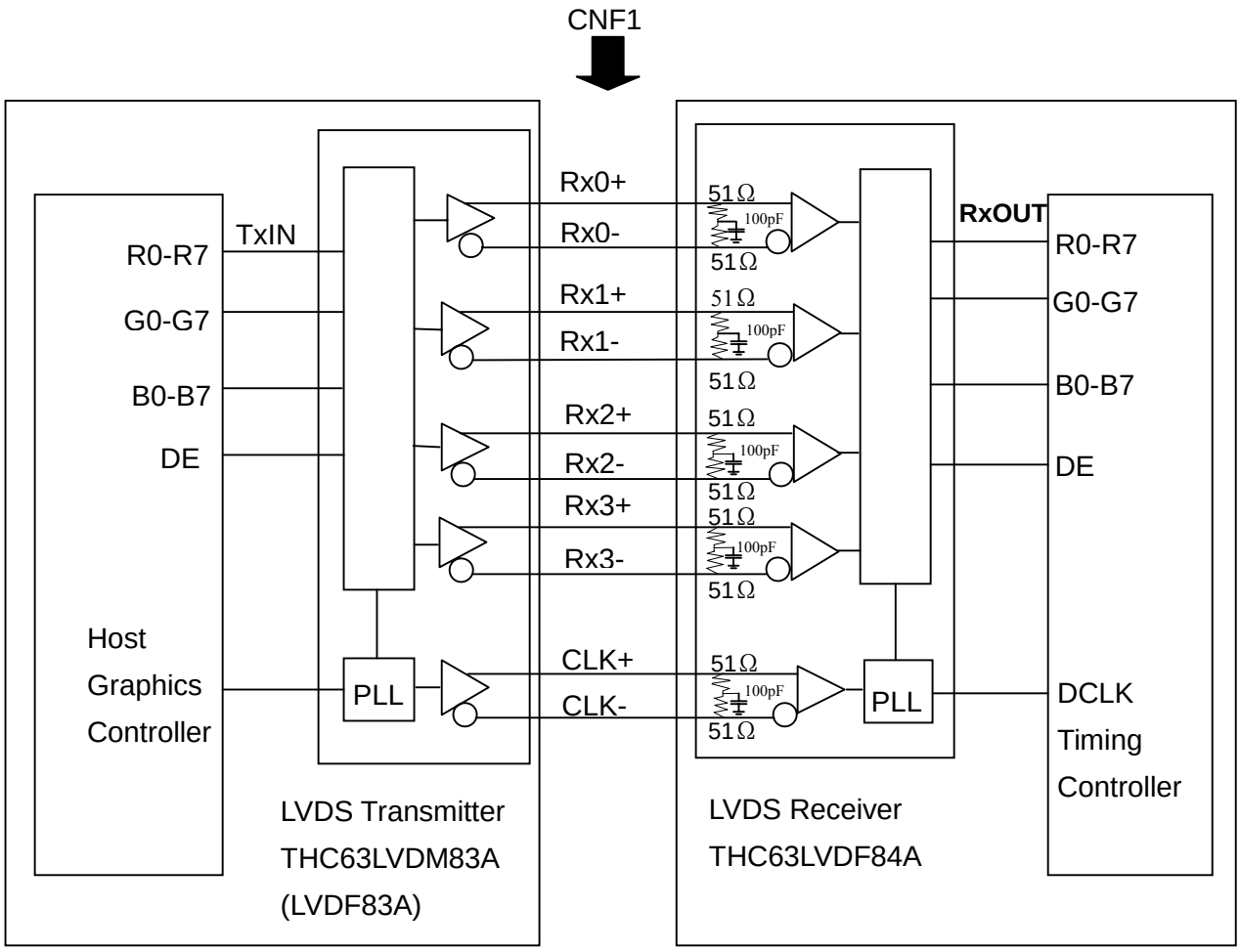
Pin No.	Symbol	Description
1	CCFL HOT	CCFL high voltage
2	CCFL HOT	CCFL high voltage

CN11(Header): S2B-ZR-SM3A-TF(D)(LF)(JST) or equivalent

Pin No.	Symbol	Description
1	CCFL COLD	CCFL low voltage (+)
2	CCFL COLD	CCFL low voltage (-)

Note (1) Floating of any control signal is not allowed.

5.4 BLOCK DIAGRAM OF INTERFACE



R0~R7 : Pixel R Data ,

G0~G7 : Pixel G Data ,

B0~B7 : Pixel B Data ,

DE : Data enable signal

Note (1) The system must have the transmitter to drive the module.

Note (2) LVDS cable impedance shall be 50 ohms per signal line or about 100 ohms per twist-pair line when it is used differentially.

5.5 LVDS INTERFACE

	SIGNAL		TRANSMITTER THC63LVDM83A		INTERFACE CONNECTOR		RECEIVER THC63LVDF84A		TFT CONTROL INPUT	
	SELLVDS =L or OPEN	SELLVDS =H	PIN	INPUT	Host	TFT-LCD	PIN	OUTPUT	SELLVDS =L or OPEN	SELLVDS =H
24 bit	R0	R2	51	TxIN0			27	Rx OUT0	R0	R2
	R1	R3	52	TxIN1			29	Rx OUT1	R1	R3
	R2	R4	54	TxIN2	TA OUT0+	Rx 0+	30	Rx OUT2	R2	R4
	R3	R5	55	TxIN3			32	Rx OUT3	R3	R5
	R4	R6	56	TxIN4			33	Rx OUT4	R4	R6
	R5	R7	3	TxIN6	TA OUT0-	Rx 0-	35	Rx OUT6	R5	R7
	G0	G2	4	TxIN7			37	Rx OUT7	G0	G2
	G1	G3	6	TxIN8			38	Rx OUT8	G1	G3
	G2	G4	7	TxIN9			39	Rx OUT9	G2	G4
	G3	G5	11	TxIN12	TA OUT1+	Rx 1+	43	Rx OUT12	G3	G5
	G4	G6	12	TxIN13			45	Rx OUT13	G4	G6
	G5	G7	14	TxIN14			46	Rx OUT14	G5	G7
	B0	B2	15	TxIN15	TA OUT1-	Rx 1-	47	Rx OUT15	B0	B2
	B1	B3	19	TxIN18			51	Rx OUT18	B1	B3
	B2	B4	20	TxIN19			53	Rx OUT19	B2	B4
	B3	B5	22	TxIN20			54	Rx OUT20	B3	B5
	B4	B6	23	TxIN21	TA OUT2+	Rx 2+	55	Rx OUT21	B4	B6
	B5	B7	24	TxIN22			1	Rx OUT22	B5	B7
	DE	DE	30	TxIN26			6	Rx OUT26	DE	DE
	R6	R0	50	TxIN27	TA OUT2-	Rx 2-	7	Rx OUT27	R6	R0
	R7	R1	2	TxIN5			34	Rx OUT5	R7	R1
	G6	G0	8	TxIN10			41	Rx OUT10	G6	G0
	G7	G1	10	TxIN11			42	Rx OUT11	G7	G1
	B6	B0	16	TxIN16	TA OUT3+	Rx 3+	49	Rx OUT16	B6	B0
	B7	B1	18	TxIN17			50	Rx OUT17	B7	B1
	RSVD 1	RSVD 1	25	TxIN23			2	Rx OUT23	NC	NC
	RSVD 2	RSVD 2	27	TxIN24	TA OUT3-	Rx 3-	3	Rx OUT24	NC	NC
	RSVD 3	RSVD 3	28	TxIN25			5	Rx OUT25	NC	NC
	DCLK		31	TxCLK IN	TxCLK OUT+ TxCLK OUT-	RxCLK IN+ RxCLK IN-	26	RxCLK OUT	DCLK	

R0~R7: Pixel R Data (7; MSB, 0; LSB)

G0~G7: Pixel G Data (7; MSB, 0; LSB)

B0~B7: Pixel B Data (7; MSB, 0; LSB)

DE: Data enable signal

Notes(1) RSVD(reserved)pins on the transmitter shall be “H” or(“L” or OPEN)

5.6 COLOR DATA INPUT ASSIGNMENT

The brightness of each primary color (red, green and blue) is based on the 8-bit gray scale data input for the color. The higher the binary input, the brighter the color. The table below provides the assignment of color versus data input.

Color		Data Signal																							
		Red								Green								Blue							
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
Basic Colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Gray Scale Of Red	Red(0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(1)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(2)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Red(253)	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(254)	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gray Scale Of Green	Green(0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	Green(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Green(253)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0
	Green(254)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
	Green(255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Gray Scale Of Blue	Blue(0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Blue(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Blue(253)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1
	Blue(254)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0
	Blue(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

Note (1) 0: Low Level Voltage, 1: High Level Voltage

6. INTERFACE TIMING

6.1 INPUT SIGNAL TIMING SPECIFICATIONS

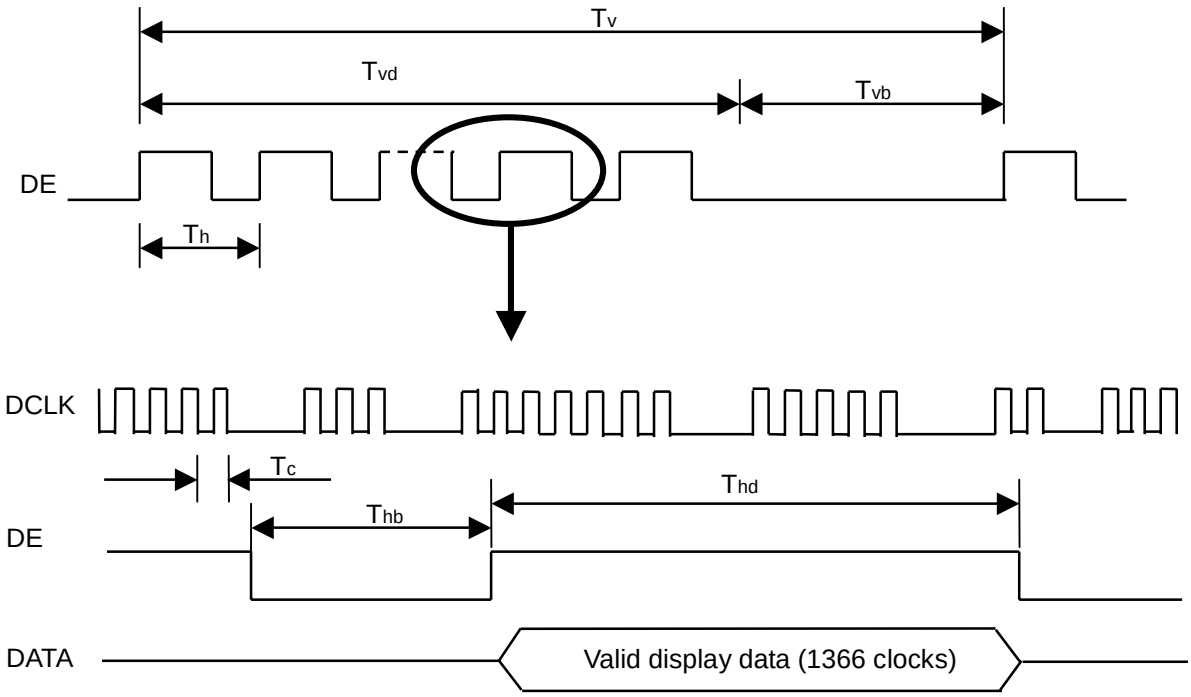
The input signal timing specifications are shown as the following table and timing diagram.

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
LVDS Receiver Clock	Frequency	1/Tc	60	86	88	MHz	
	Input cycle to cycle jitter	Trcl	-	-	200	ps	
LVDS Receiver Data	Setup Time	Tlvsu	600	-	-	ps	
	Hold Time	Tlvhd	600	-	-	ps	
Vertical Active Display Term	Frame Rate	Fr_5	47	50	53	Hz	(2)
		Fr_6	57	60	63	Hz	
	Total	Tv	778	795	888	Th	Tv=Tvd+Tvb
	Display	Tvd	768	768	768	Th	-
	Blank	Tvb	10	27	120	Th	-
Horizontal Active Display Term	Total	Th	1436	1798	1936	Tc	Th=Thd+Thb
	Display	Thd	1366	1366	1366	Tc	-
	Blank	Thb	70	432	570	Tc	-

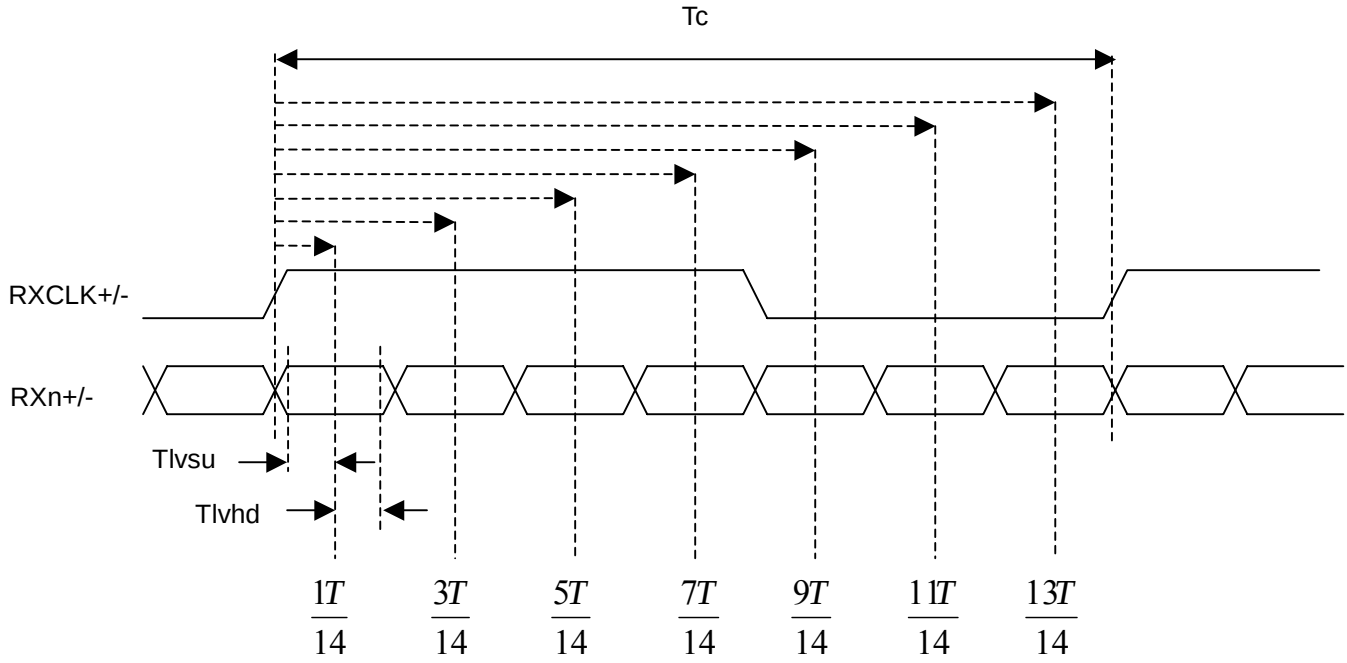
Note (1) Since this module is operated in DE only mode, Hsync and Vsync input signals should be set to low logic level. Otherwise, this module would operate abnormally.

(2) Please refer to 5.1 for detail information.

INPUT SIGNAL TIMING DIAGRAM

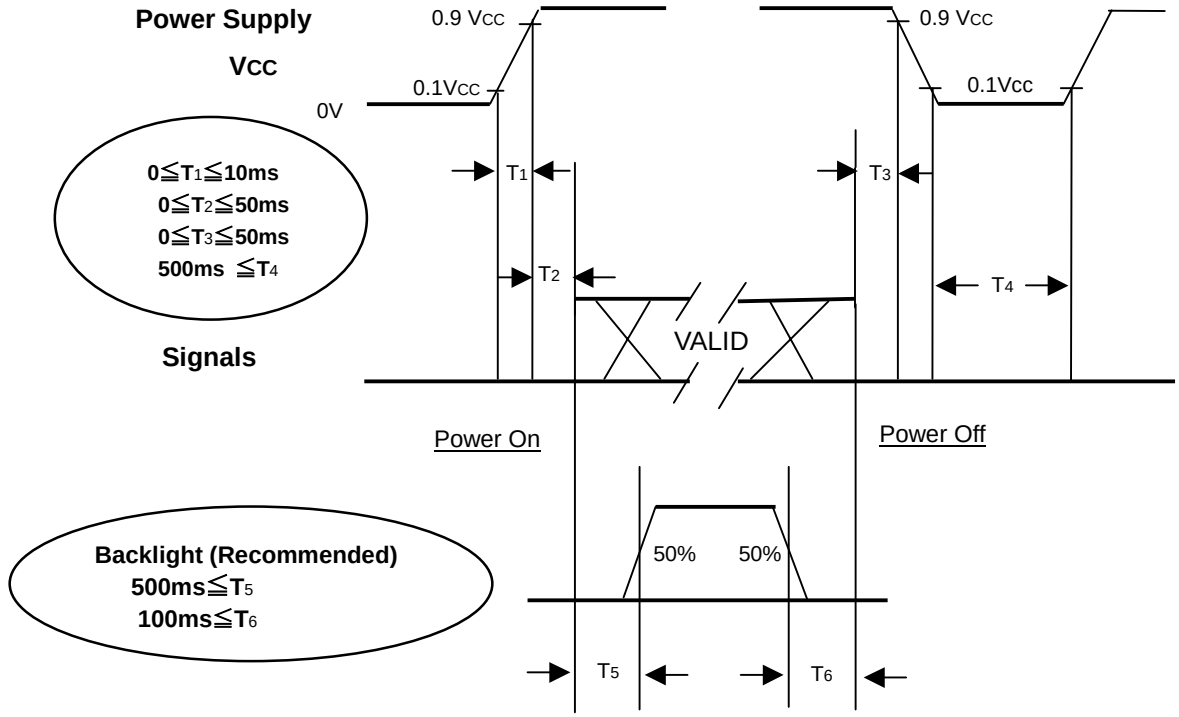


LVDS RECEIVER INTERFACE TIMING DIAGRAM



6.2 POWER ON/OFF SEQUENCE

To prevent a latch-up or DC operation of LCD module, the power on/off sequence should be as the diagram below.



Power ON/OFF Sequence

Note (1) The supply voltage of the external system for the module input should follow the definition of Vcc.

Note (2) Apply the lamp voltage within the LCD operation range. When the backlight turns on before the LCD operation or the LCD turns off before the backlight turns off, the display may momentarily become abnormal screen.

Note (3) In case of Vcc is in off level, please keep the level of input signals on the low or high impedance.

Note (4) T4 should be measured after the module has been fully discharged between power off and on period.

Note (5) Interface signal shall not be kept at high impedance when the power is on.

7. OPTICAL CHARACTERISTICS

7.1 TEST CONDITIONS

Item	Symbol	Value	Unit
Ambient Temperature	Ta	25±2	°C
Ambient Humidity	Ha	50±10	%RH
Supply Voltage	V_{CC}	5.0	V
Input Signal	According to typical value in "3. ELECTRICAL CHARACTERISTICS"		
Lamp Current	I_L	4.5 ± 0.5	mA
Oscillating Frequency (Inverter)	F_W	62.5 ± 3	KHz

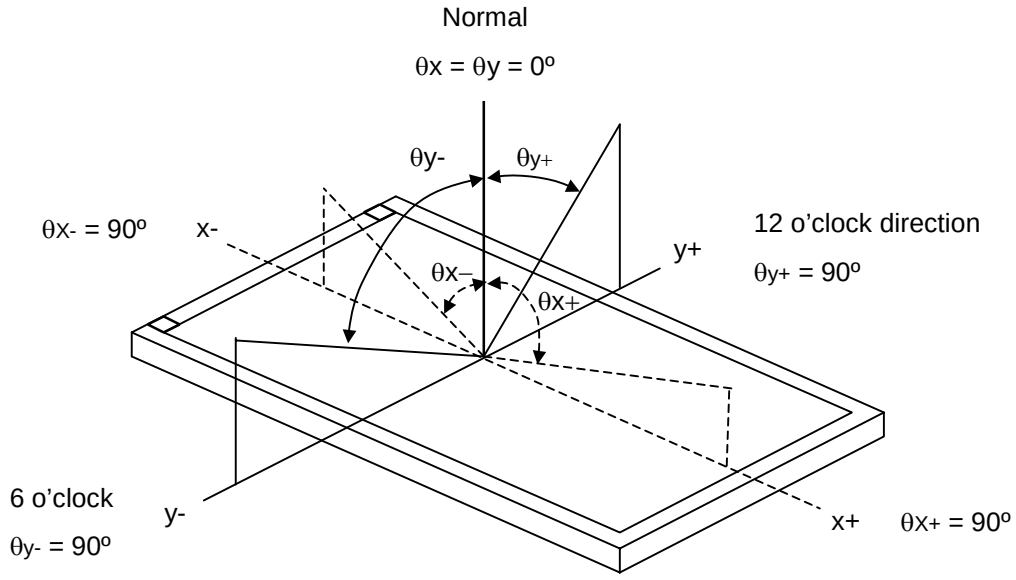
7.2 OPTICAL SPECIFICATIONS

The relative measurement methods of optical characteristics are shown in 7.2. The following items should be measured under the test conditions described in 7.1 and stable environment shown in Note (6).

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio		CR	θ_x=0°, θ_Y =0° Viewing Normal Angle	800	1000	-	-	(2)
Response Time		Gray to gray average		-	8	12	ms	(3)
Center Luminance of White		L_C		450	550	-	cd/m^2	(4)
Average Luminance of White		L_{AVE}		400	450	-	cd/m^2	
White Variation		δW		-	-	1.3	-	(7)
Cross Talk		CT		-	-	4.0	%	(5)
Color Chromaticity	Red	Rx		0.622	0.652	0.682	-	(6)
		Ry		0.302	0.332	0.362	-	
	Green	Gx		0.240	0.270	0.300	-	
		Gy		0.559	0.589	0.619	-	
	Blue	Bx		0.111	0.141	0.171	-	
		By		0.038	0.068	0.098	-	
	White	Wx		0.255	0.285	0.315	-	
		Wy		0.263	0.293	0.323	-	
	Color Gamut	CG		72	75		%	NTSC
Viewing Angle	Horizontal	θ_x+	CR≥20	80	88	-	Deg.	(1)
		θ_x-		80	88	-		
	Vertical	θ_Y+		80	88	-		
		θ_Y-		80	88	-		

Note (1) Definition of Viewing Angle (θx, θy):

Viewing angles are measured by EZ-Contrast 160R (Eldim)



Note (2) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.

Contrast Ratio (CR) = L255 / L0

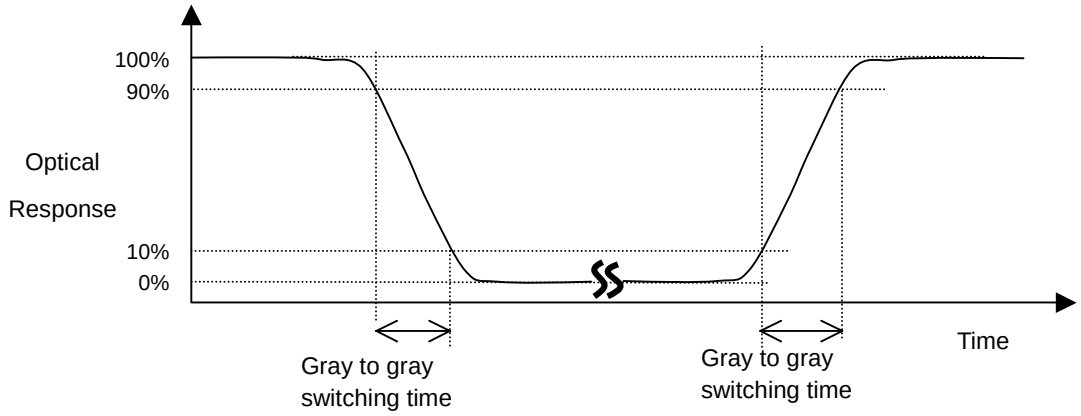
L255: Luminance of gray level 255

L 0: Luminance of gray level 0

CR = CR (5)

CR (X) is corresponding to the Contrast Ratio of the point X at the figure in Note (8).

Note (3) Definition of Gray to Gray Switching Time :



The driving signal means the signal of gray level 0, 63, 127, 191, 255.

Gray to gray average time means the average switching time of gray level 0 ,63,127,191,255 to each other .

Note (4) Definition of Luminance of White (L_C, L_{AVE}):

Measure the luminance of gray level 255 at center point and 5 points

$L_C = L(5)$

$L_{AVE} = [L(1)+ L(2)+ L(3)+ L(4)+ L(5)] / 5$

L (x) is corresponding to the luminance of the point X at the figure in Note (8).

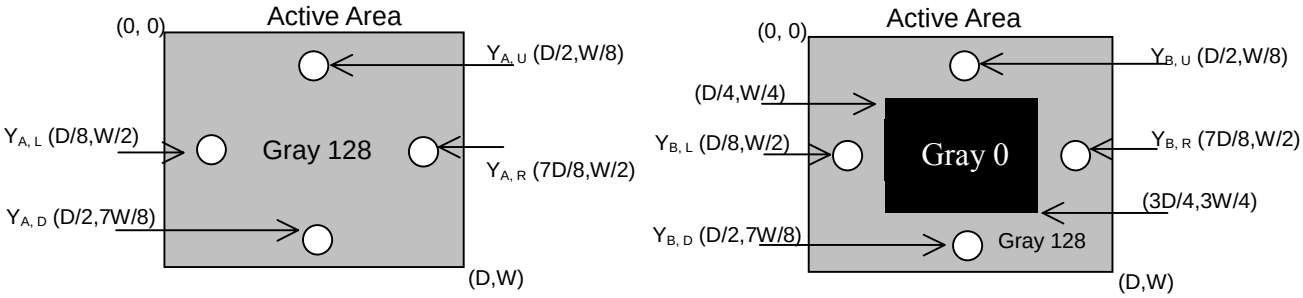
Note (5) Definition of Cross Talk (CT):

$CT = | Y_B – Y_A | / Y_A \times 100$ (%)

Where:

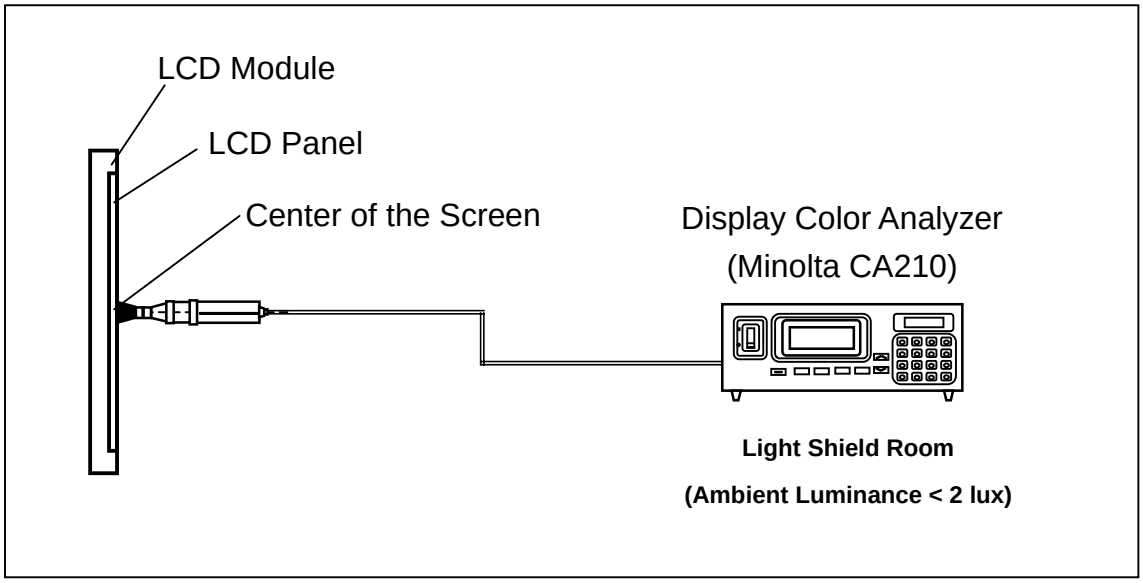
Y_A = Luminance of measured location without gray level 0 pattern (cd/m^2)

Y_B = Luminance of measured location with gray level 0 pattern (cd/m^2)



Note (6) Measurement Setup:

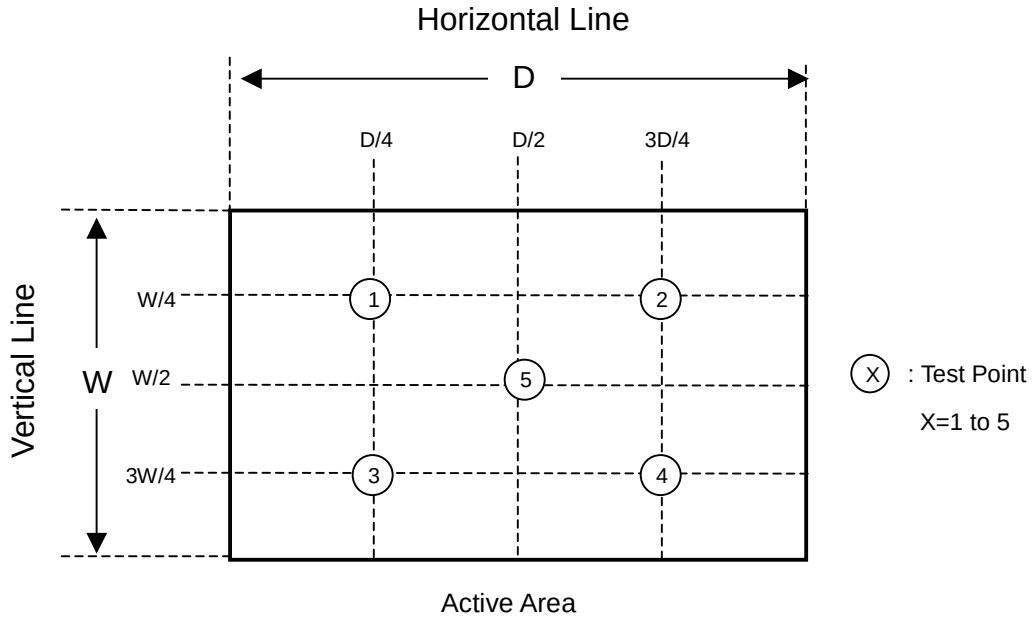
The LCD module should be stabilized at given temperature for 1 hour to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 1 hour in a windless room.



Note (7) Definition of White Variation (δW):

Measure the luminance of gray level 255 at 5 points

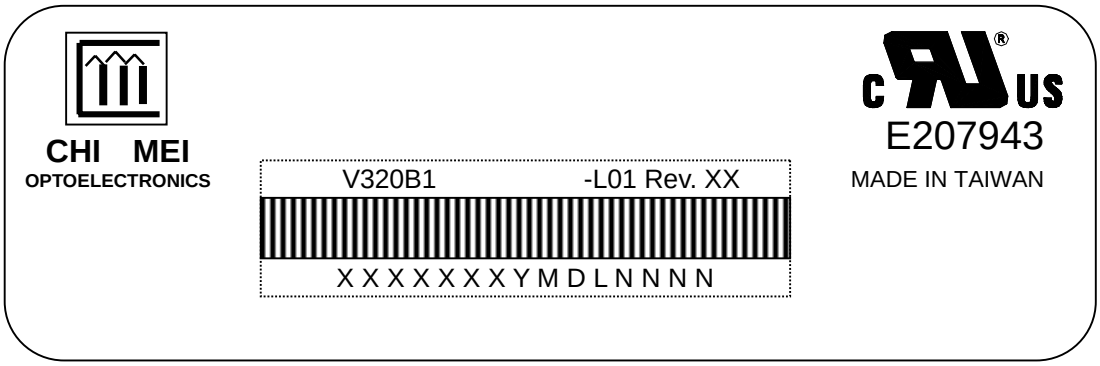
δW = Maximum [L (1), L (2), L (3), L (4), L (5)] / Minimum [L (1), L (2), L (3), L (4), L (5)]



8. DEFINITION OF LABELS

8.1 CMO MODULE LABEL

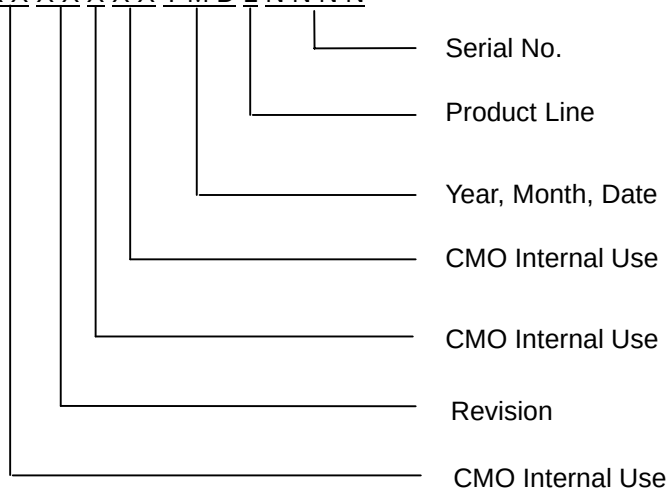
The barcode nameplate is pasted on each module as illustration, and its definitions are as following explanation.



(a) Model Name: V320B1-L01

(b) Revision: Rev. XX, for example: A0, A1… B1, B2… or C1, C2…etc.

(c) Serial ID: X X X X X X X Y M D L N N N N



Serial ID includes the information as below:

(a) Manufactured Date: Year: 0~9, for 2000~2009

Month: 1~9, A~C, for Jan. ~ Dec.

Day: 1~9, A~Y, for 1st to 31st, exclude I ,O, and U.

(b) Revision Code: Cover all the change

(c) Serial No.: Manufacturing sequence of product

(d) Product Line: 1 -> Line1, 2 -> Line 2, …etc.

9. PACKAGING

9.1 PACKING SPECIFICATIONS

(1) 4 LCD TV modules / 1 Box

(2) Box dimensions : 906(L) X 384 (W) X 580 (H)

(3) Weight : approximately 28Kg (4 modules per box)

9.2 PACKING METHOD

Figures 9-1 and 9-2 are the packing method

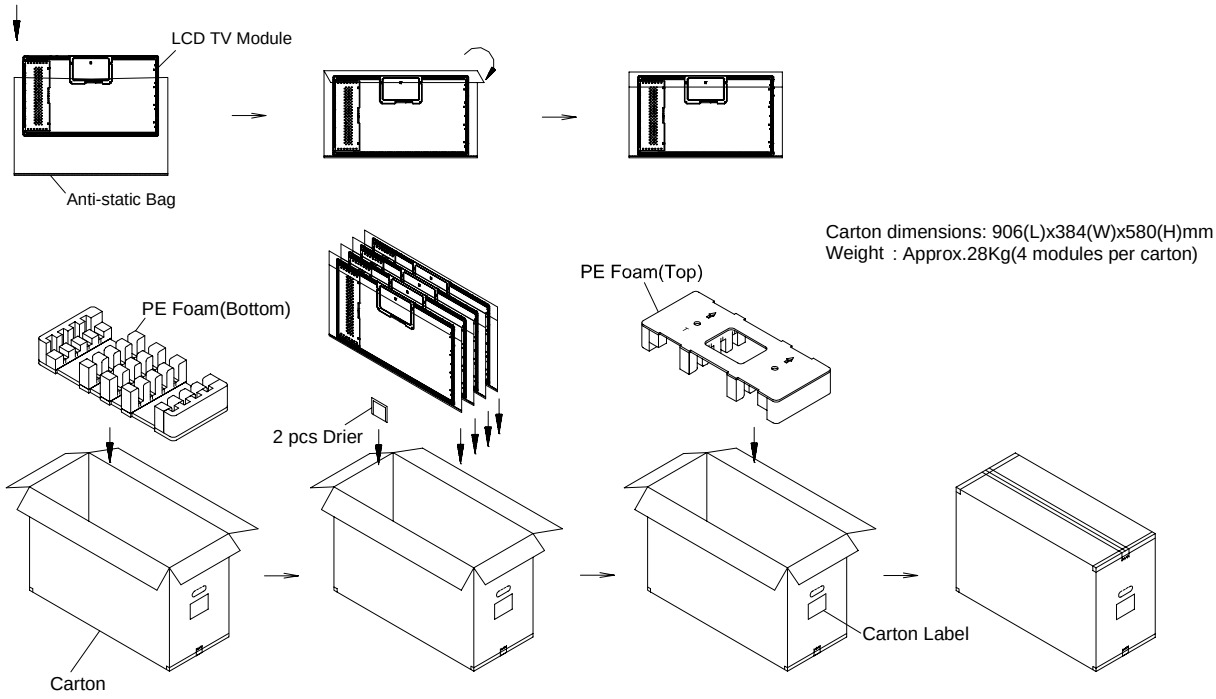
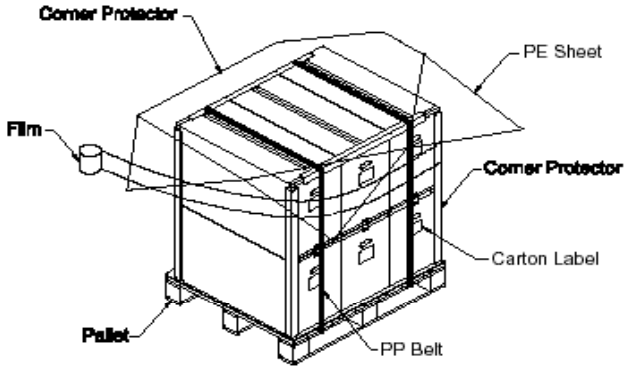


Figure.9-1 packing method

Air Transportation

Corner Protector:L1130*50mm*50mm
Pallet:L930*W1180*H140mm
Pallet Stack:L930*W1180*H1300mm
Gross:182kg



Sea Transportation

Corner Protector:L1130*50mm*50mm
Corner Protector:L1400*50mm*50mm
Pallet:L930*W1180*H140mm
Pallet Stack:L930*W1180*H1880mm
Gross:267kg

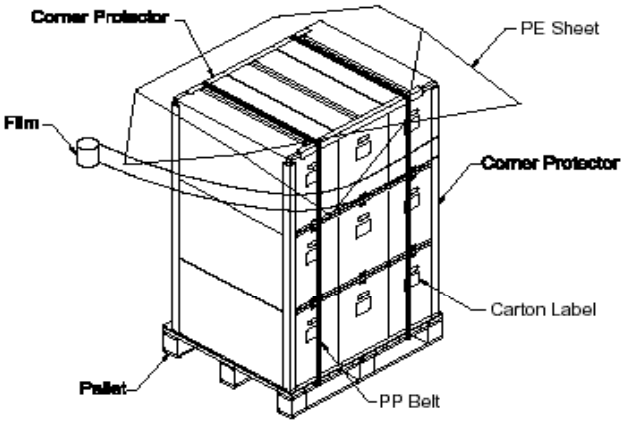


Figure. 9-2 Packing method

10. PRECAUTIONS

10.1 ASSEMBLY AND HANDLING PRECAUTIONS

(1) Do not apply rough force such as bending or twisting to the module during assembly.

(2) It is recommended to assemble or to install a module into the user's system in clean working areas. The dust and oil may cause electrical short or worsen the polarizer.

(3) Do not apply pressure or impulse to the module to prevent the damage of LCD panel and backlight.

(4) Always follow the correct power-on sequence when the LCD module is turned on. This can prevent the damage and latch-up of the CMOS LSI chips.

(5) Do not plug in or pull out the I/F connector while the module is in operation.

(6) Do not disassemble the module.

(7) Use a soft dry cloth without chemicals for cleaning, because the surface of polarizer is very soft and easily scratched.

(8) Moisture can easily penetrate into LCD module and may cause the damage during operation.

(9) High temperature or humidity may deteriorate the performance of LCD module. Please store LCD modules in the specified storage conditions.

(10) When ambient temperature is lower than 10ºC, the display quality might be reduced. For example, the response time will become slow, and the starting voltage of CCFL will be higher than that of room temperature.

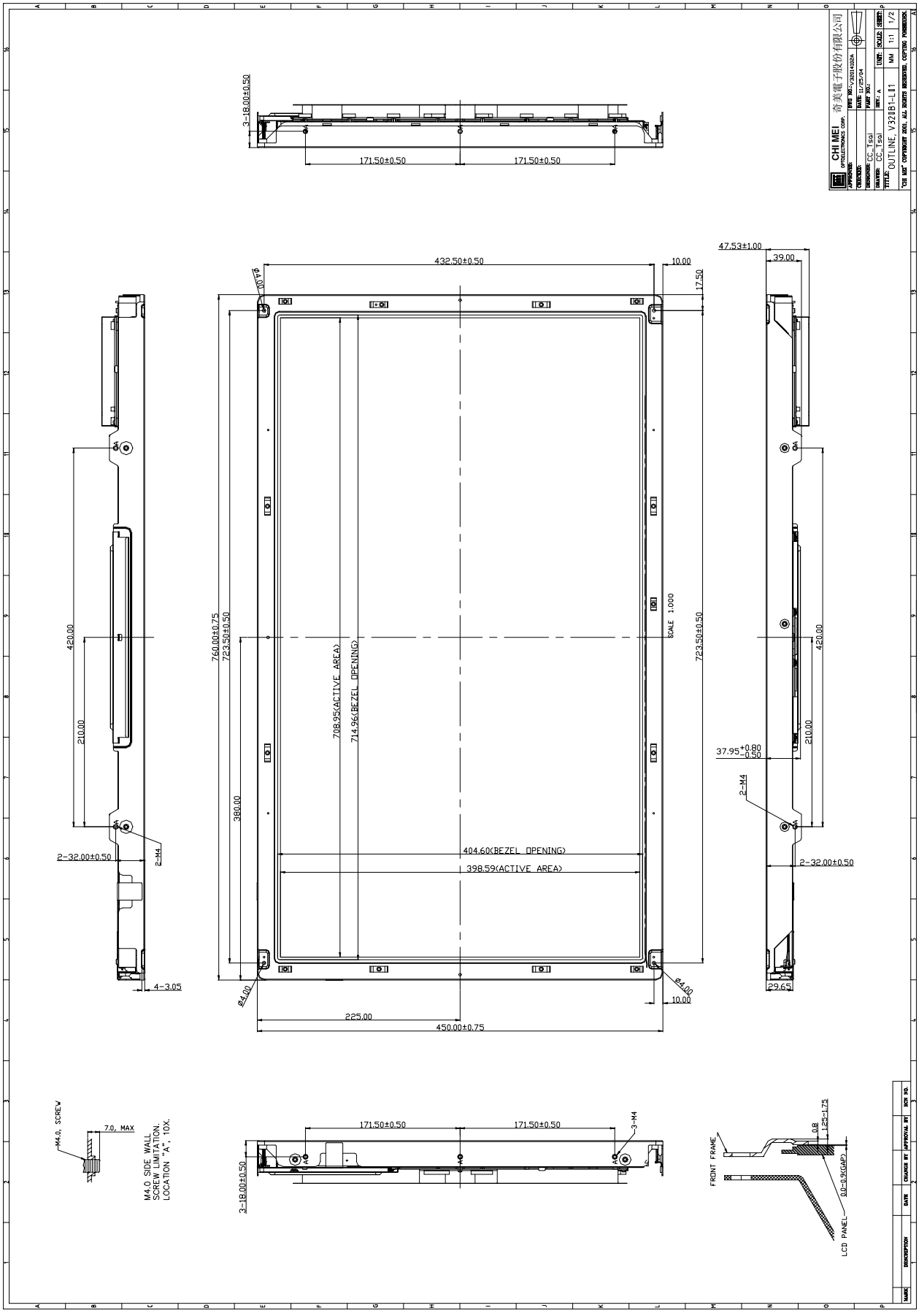
10.2 SAFETY PRECAUTIONS

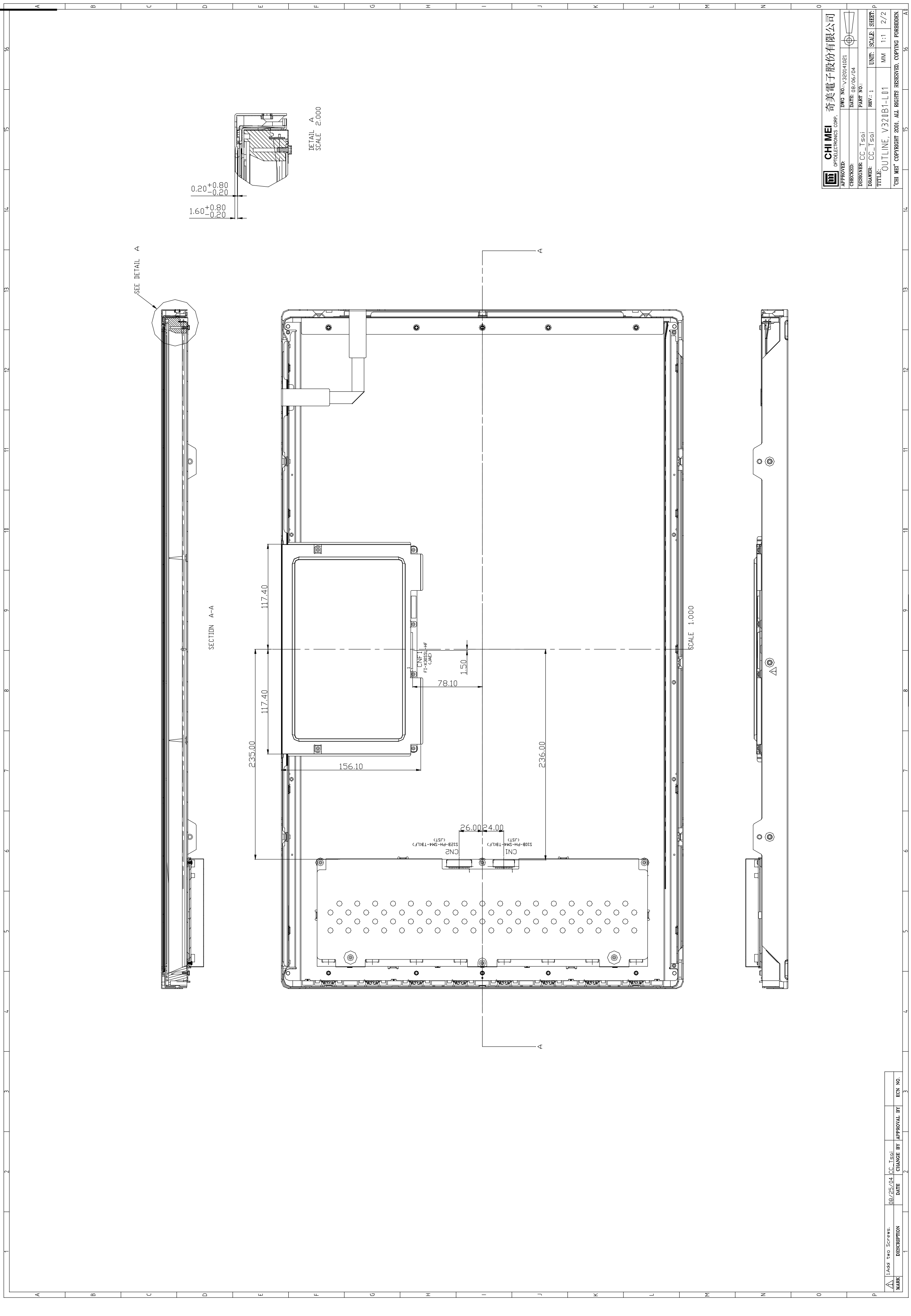
(1) The startup voltage of a backlight is over 1000 Volts. It may cause an electrical shock while assembling with the inverter. Do not disassemble the module or insert anything into the backlight unit.

(2) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, skin or clothes, it has to be washed away thoroughly with soap.

(3) After the module's end of life, it is not harmful in case of normal operation and storage.

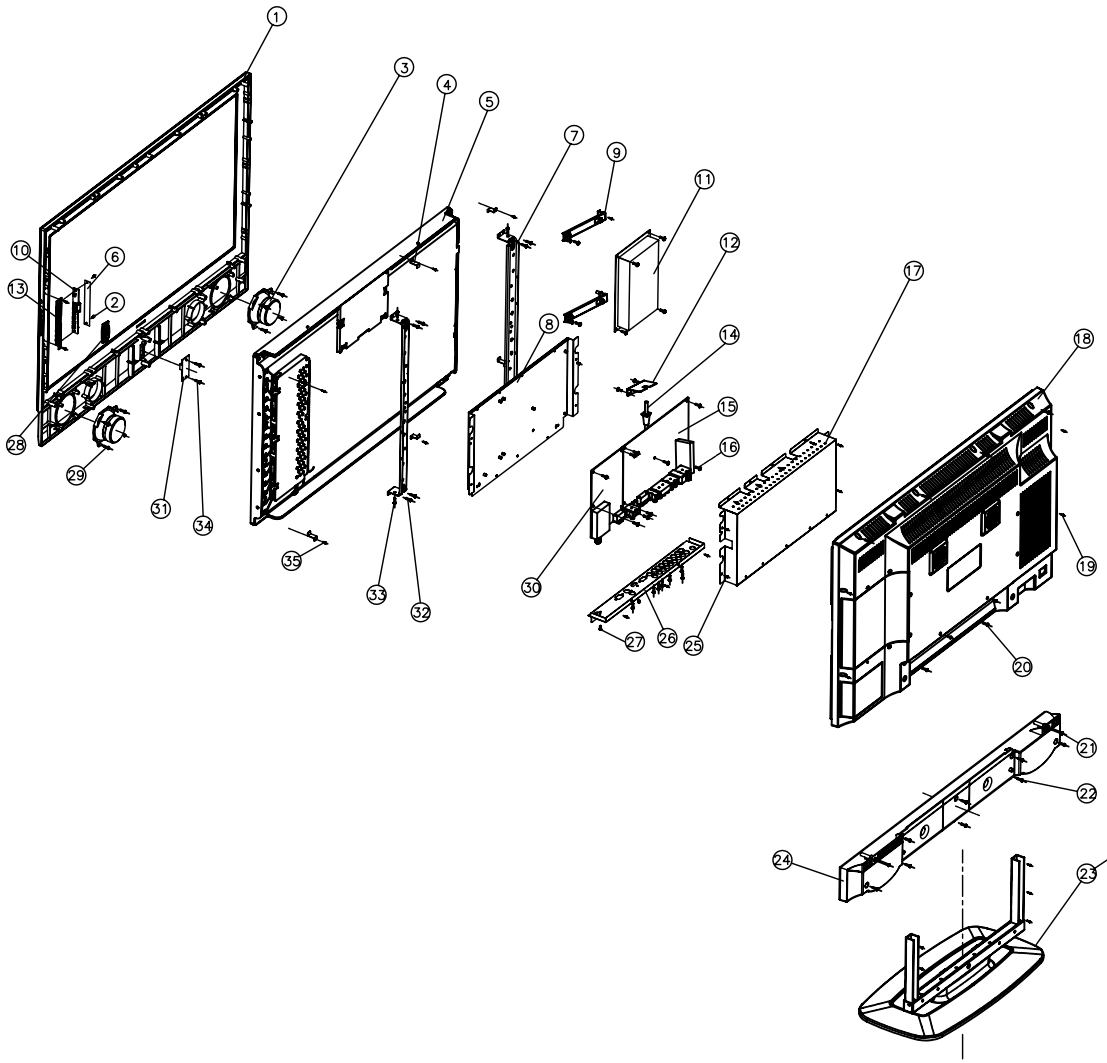
11. MECHANICAL CHARACTERISTICS

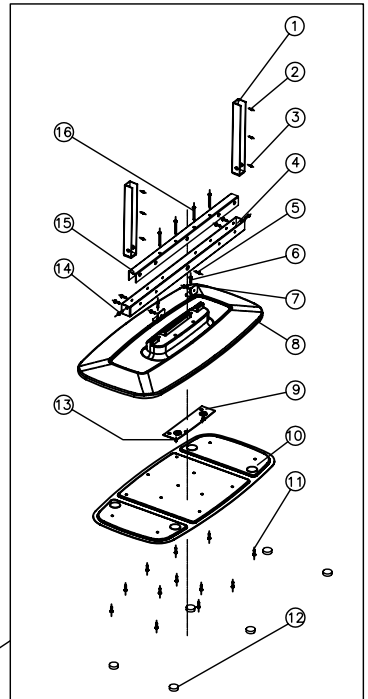



DETAIL A
SCALE 2.000
0.20 +0.80 −0.20
1.60 +0.80 −0.20
SEE DETAIL A
SECTION A-A
SCALE 1.000
A
117.40
117.40
235.00
156.10
CNF1
FI-X30SSL-HF
(JAE)
1.50
78.10
236.00
26.00
24.00
CN2
S12B-PH-SM4-TB(LF)
(JST)
CN1
S10B-PH-SM4-TB(LF)
(JST)
CHI MEI
OPTOELECTRONICS CORP.
奇美電子股份有限公司
APPROVED:
CHECKED:
DESIGNER: CC_Tsai
DRAWER: CC_Tsai
TITLE: OUTLINE, V320B1-L01
DWG NO.: V320141021
DATE: 08/06/04
PART NO.:
REV.: 1
UNIT: MM
SCALE: 1:1
SHEET: 2/2
"CHI MEI" COPYRIGHT 2001, ALL RIGHTS RESERVED, COPYING FORBIDDEN.
1.Add two Screws.
08/25/04
CC_Tsai
MARK
DESCRIPTION
DATE
CHANGE BY
APPROVAL BY
ECN NO.

NOTE : THIS RELEASED DRAWING WAS PRODUCED BY COMPUTER , DO NOT UPDATE MASTER MANUALLY

DWG. REV.	ZONE	DESCRIPTION	DATE	REVISOR





ITEM	PART NO.	DESCRIPTION	QTY	MATERIAL
16	603-407040-00	MACH SCREW TRS M4X40MM	4	
15	429-L32AB36-01	U TOP CROSSBEAM	1	SECC T=2
14	602-407008-00	MACH.SCREW WASHER 4X8	12	
13	614-300108-00	S-TAP. SCREW 3X8	2	
12	370-42D101-01	RUBBER FOOT	6	RUBBER
11	610-350210-10	S-TAP.SCREW 3.5X10	11	
10	429-L32AB11-01	BASE SHEET	1	SECC T=1.0
9	429-L32AB09-01	SECURE SHEET	1	SECC T=1.0
8	231-L32AB21-01R	BASE COVER	1	HIPS
7	429-L32AB03-01	L SHEET	2	SECC T=2
6	604-407012-00	MACH.SCREW M4X12	2	
5	601-407010-00	MACH.SCREW M4X10	1	
4	429-L32AB35-01	U BOTTOM CROSSBEAM	1	SECC T=2
3	604-407016-00	MACH.SCREW M4X16	4	
2	614-400412-00	S-TAP. SCREW BID 4X12	2	
1	429-L32AD13-011	SECURE LEG	2	SECC T=2.0

ITEM	PART NO.	DESCRIPTION	QTY	MATERIAL
35	614-300408-10	S-TAP SCREW BID 3X8	18	
34	614-260208-10	S-TAP SCREW BID 2.6X8	4	
33	604-407008-10	TAPTITE SCREW 4X8	4	
32	614-400110-10	SELF TAPPING SCREW	8	
31	771BL27AD01-02	IR RECEIVE PCB ASS'Y FOR "ILO"	1	
30	771SL27AD01-01	ATSC PCB ASS'Y W/O MAX3232/SPDIF	1	
29	612-300110-10	S-TAP.SCREW WHR 3X10	8	
28	459-L32AD01-01	REMOTE LENS ASS'Y FOR ILO	1	
27	624-204005-10	S-TAP SCREW BID 2.0X5	1	
26	436-L32AB01-01S	TERMINAL SHEET FOR "ILO"	1	
25	604-305005-10	MACH.SCREW BID 3X8	15	
24	206-L32AD01-00R	SPEAKER CABINET BACK	1	HIPS
23	734-L32AD03-01	BASE ASSY		
22	614-400416-00	S-TAP.SCREW BID 4X16	14	
21	614-400445-00	S-TAP SCREW BID M4X45	2	
20	601-305008-00	MACH.SCREW CTS 3X8	4	
19	610-300115-00	S-TAP SCREW ROUND3X15	4	
18	202-L32AD32-01AA	BACK CABINET BLACK W/O DVD	1	HIPS(94V0)
17	483-L32AB32-01S	SHIELD COVER(VSC)	1	SPTE T=0.3
16	602-305006-10	MACH. SCREW WHE 3X6	30	
15	771EL27AD04-04	MAIN PCB ASSY	1	
14	E3404-157009	AC CORD UL 1.88M FOR LCD32 MT8202	1	
13	277-L32AD11-00S	FUNCTION KEY	1	ABS
12	426-L37AD01-01S	POWER CORD BKT.	1	SECC T=0.8
11	E7801-P02002	POWER ASSY	1	
10	771KL37AD01-01	FUNCTION KEY PCB ASSY	1	
9	429-L32AD0B-01S	POWER CODE BRACKET	2	SECC T=1.0
8	481-L32AB06-01S	SHIELDING BOX(VSC)	1	SECC T=0.8
7	420-L32AD13-01S	MAIN BRACKET	2	SECC T=1.5
6	384-L32AD03-01H	PVC SHEET FOR KEY	1	PVC
5	E6203-32CD01	LCD 32" CMO WXGA V320B1-L01	1	
4	429-L32AD0A-01	Z BKT. FOR PANEL	6	SECC T=1.0
3	E4801-124001	SPEAKER 8 OHM 10W D3" YD78-1	2	
2	614-220206-10	S-TAP. SCREW BID 2.2X6	2	
1	200-L32AD04-01AA	CABINET FRONT 32"LCT32AD SIL/BLK	1	HIPS(94V0)

DRAWN.	LCQ			
CHECKED				
APPRD.				
3rd ANGLE PROJECTION				

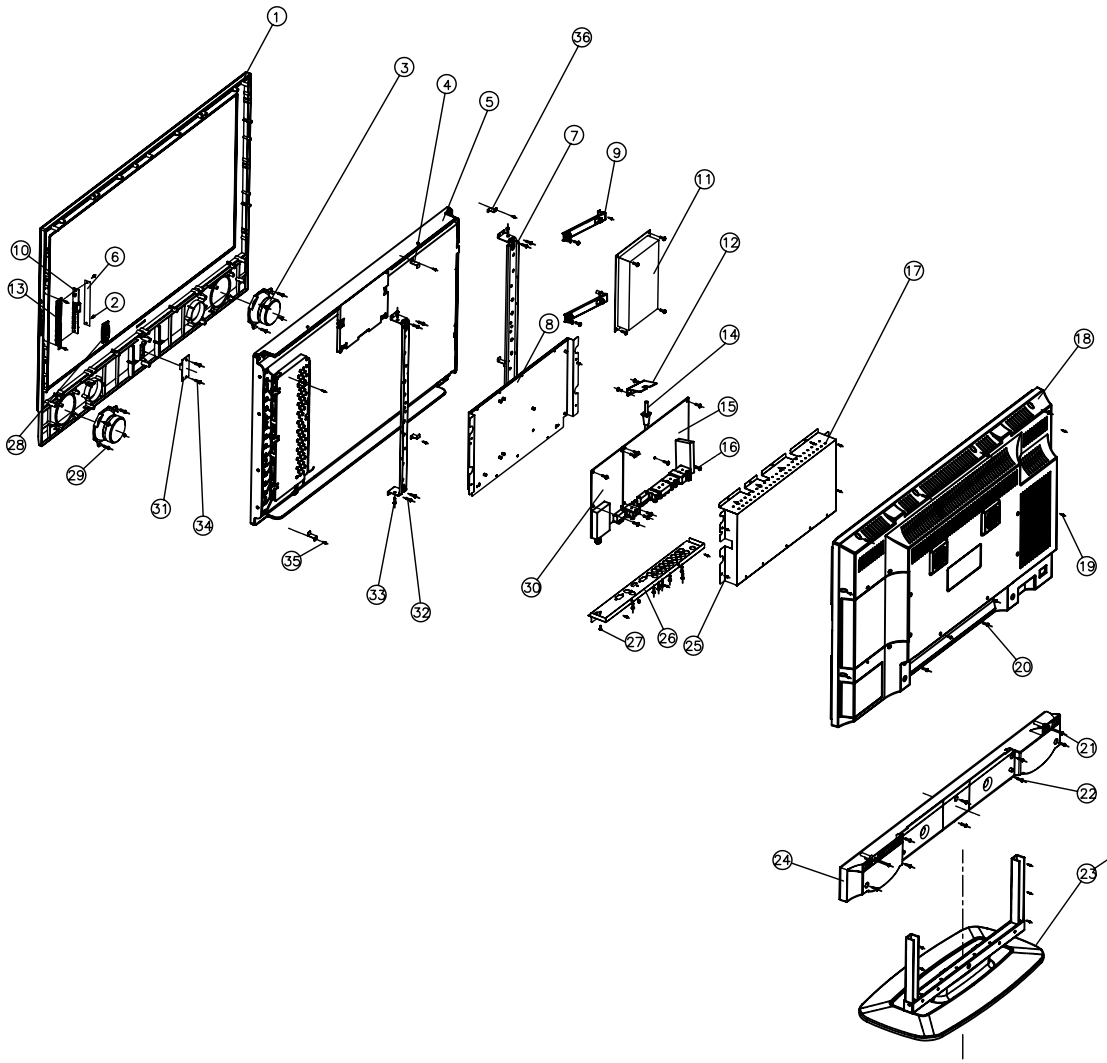
TOLERENCE UNLESS OTHERWISE SPECIFIED
0: ±0.30
0.0 ±0.10
0.00: ±0.05
ANGULAR: ±0.3°
UNIT : mm

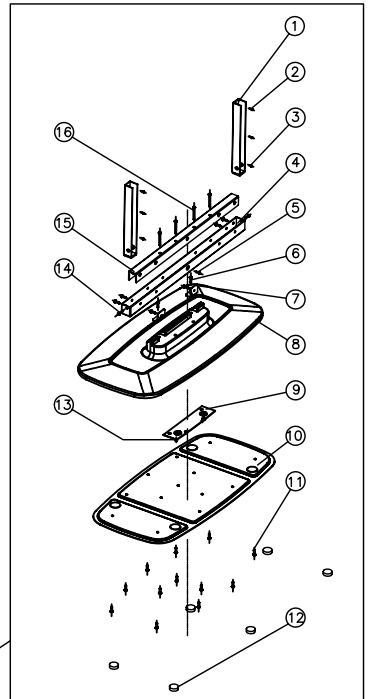
KAWA ELECTRONIC R & D CENTRE
MATL.
FINISH

TITLE LCT32ADNIA1CS-B01
MODEL NO. LCT32HA36
A3 PART NO. DWG. NO.
SCALE QTY. SHEET 1 OF 1

NOTE : THIS RELEASED DRAWING WAS PRODUCED BY COMPUTER , DO NOT UPDATE MASTER MANUALLY

DWG. REV.	ZONE	DESCRIPTION	DATE	REVISOR





36	429-L32SD04-01	Z BKT FOR PANEL B	4	
35	614-300408-10	S-TAP SCREW BID 3X8	18	
34	614-260208-10	S-TAP SCREW BID 2.6X8	4	
33	604-407008-10	TAPTITE SCREW 4X8	4	
32	614-400110-10	SELF TAPPING SCREW	8	
31	771BL27AD01-02	IR RECEIVE PCB ASS'Y FOR "ILO"	1	
30	771SL27AD01-01	ATSC PCB ASS'Y W/O MAX3232/SPDIF	1	
29	612-300110-10	S-TAP.SCREW WHR 3X10	8	
28	459-L32AD01-01	REMOTE LENS ASS'Y FOR ILO	1	
27	624-204005-10	S-TAP SCREW BID 2.0X5	1	
26	436-L32AB0I-01S	TERMINAL SHEET FOR "ILO"	1	
25	604-305005-10	MACH.SCREW BID 3X8	15	
24	206-L32AD01-00R	SPEAKER CABINET BACK	1	HIPS
23	734-L32AD03-01	BASE ASSY		
22	614-400416-00	S-TAP.SCREW BID 4X16	14	
21	614-400445-00	S-TAP SCREW BID M4X45	2	
20	601-305008-00	MACH.SCREW CTS 3X8	4	
19	610-300115-00	S-TAP SCREW ROUND3X15	4	
18	202-L32AD32-01AA	BACK CABINET BLACK W/O DVD	1	HIPS(94V0)
17	483-L32AB32-01S	SHIELD COVER(VSC)	1	SPTE T=0.3
16	602-305006-10	MACH. SCREW WHE 3X6	23	
15	771EL27AD04-04	MAIN PCB ASSY	1	
14	E3404-157009	AC CORD UL 1.88M FOR LCD32 MT8202	1	
13	277-L32AD11-00S	FUNCTION KEY	1	ABS
12	426-L37AD01-01S	POWER CORD BKT.	1	SECC T=0.8
11	E7801-P02002	POWER ASSY	1	
10	771KL37AD01-01	FUNCTION KEY PCB ASSY	1	
9	429-L32AD0B-01S	POWER CODE BRACKET	2	SECC T=1.0
8	481-L32AB06-01S	SHIELDING BOX(VSC)	1	SECC T=0.8
7	420-L32AD13-01S	MAIN BRACKET	2	SECC T=1.5
6	384-L32AD03-01H	PVC SHEET FOR KEY	1	PVC
5	E6203-32CD03	LCD 32" CMO WXGA V320B1-L06	1	
4	429-L32SD15-01	Z BRACKET "C"	1	SECC T=1.0
3	E4801-124001	SPEAKER 8 OHM 10W D3" YD78-1	2	
2	614-220206-10	S-TAP. SCREW BID 2.2X6	2	
1	200-L32AD04-01AA	CABINET FRONT 32"LCT32AD SIL/BLK	1	HIPS(94V0)
IETM	PART NO.	DESCRIPTION	QTY	MATERIAL

16	603-407040-00	MACH SCREW TRS M4X40MM	4	
15	429-L32AB36-01	U TOP CROSSBEAM	1	SECC T=2
14	602-407008-00	MACH.SCREW WASHER 4X8	12	
13	614-300108-00	S-TAP. SCREW 3X8	2	
12	370-42D101-01	RUBBER FOOT	6	RUBBER
11	610-350210-10	S-TAP.SCREW 3.5X10	11	
10	429-L32AB11-01	BASE SHEET	1	SECC T=1.0
9	429-L32AB09-01	SECURE SHEET	1	SECC T=1.0
8	231-L32AB21-01R	BASE COVER	1	HIPS
7	429-L32AB03-01	L SHEET	2	SECC T=2
6	604-407012-00	MACH.SCREW M4X12	2	
5	601-407010-00	MACH.SCREW M4X10	1	
4	429-L32AB35-01	U BOTTOM CROSSBEAM	1	SECC T=2
3	604-407016-00	MACH.SCREW M4X16	4	
2	614-400412-00	S-TAP. SCREW BID 4X12	2	
1	429-L32AD13-011	SECURE LEG	2	SECC T=2.0
IETM	PART NO.	DESCRIPTION	QTY	MATERIAL

DRAWN.	LCQ					
CHECKED						
APPRD.						
3rd ANGLE PROJECTION						

TOLERENCE UNLESS OTHERWISE SPECIFIED

0:	±0.30
0.0	±0.10
0.00:	±0.05
ANGULAR:	±0.3°
UNIT :	mm

KAWA ELECTRONIC R & D CENTRE

MATL.

FINISH

TITLE LCT32ADAIA1CS-F01

MODEL NO. LCT32HA36

A3 PART NO. DWG. NO.

SCALE QTY. SHEET 1 OF 1

Spare part list for LCT32HA36

Item	Part Number	Part Description	Usage / unit	Unit	Key/Spare
1>	LCT32ADNIA1CS-B01	ILO LCT32AD (LCT32HA36) S-MT8202 +CMO AC120V/60HZ USA SILVER/BLACK			
	510-L32AD01-13AK	CARTON BOX ILO LCT32HA36 CMO PANEL K	1.000000	Piece	K
2>	580-L32AD2A-05AP	IB E FOR ILO LCT32HA36 TV+DTV CMO S-MT8202 USA	1.000000	Piece	K
3>	E3407-081001	CORD FFC P0.5 50P L=110 B-0.5-50X110-4(8)X4(8)-0.3X0.035	1.000000	Piece	K
4>	E7501-056104	REMOTE CONTROL K001 "ILO" 44KEYS MT8202 LCD TV USA BLACK	1.000000	SET	K
5>	E7801-P02002	PCB ASSY PSU BOARD MEGMEET MLT169 FOR 32LCD AC110-240V OUTPUT 12V/8V/24V 220W	1.000000	SET	K
6>	771EL27AD04-04	PCB ASS'Y MAIN S-MT8202 FOR LCT27"	1.000000	SET	K
7>	771SL27AD01-01	ATSC TUNER PCB ASS'Y (MT5111CE) W/O MAX3232/SPOIF	1.000000	SET	K
8>	200-L32AD04-01AA	CABINET FRONT 32" LCT32AD SIL/ BLK A	1.000000	Piece	S
9>	202-L32AD32-01AA	BACK CABINET BLACK W/O DVD	1.000000	Piece	S
10>	206-L32AD01-01R	SPK CABINET BACK BLACK	1.000000	Piece	S
11>	277-L32AD11-01S	FUNCTION KEY SIL(MATERIAL: BLACK) LCT32SD	1.000000	Piece	S
12>	300-L32AD08-01C	POLYFOAM LEFT TOP LCT32AD	1.000000	Piece	S
13>	300-L32AD09-01C	POLYFOAM RIGHT TOP LCT32AD	1.000000	Piece	S
14>	300-L32AD0A-01C	POLYFOAM LEFT BOTTM LCT32AD	1.000000	Piece	S
15>	300-L32AD0B-01C	POLYFOAM RIGHT BOTTOM LCT32AD	1.000000	Piece	S
16>	310-030404-01	POLYBAG 110MMX80MMX0.04MM	1.000000	Piece	S
17>	310-041204-01V	POLYBAG 4"X12"X0.04 AV	1.000000	Piece	S
18>	310-111404-07V	POLYBAG 11"X14"X0.04 FV	1.000000	Piece	S

19>	310-423850-07V	BAG LAMIFILM 42"X38"X0.5MM	1.000000	Piece	S
20>	370-42D102-01	PAD CORD SPONG FOR SPK	1.000000	Piece	S
21>	384-L32AD03-01H	PVC SHEET FOR KEY	1.000000	Piece	S
22>	389-L32AB01-01	PVC SHEET L32AB	2.000000	Piece	S
23>	426-L37AD01-01S	AC LINE BRACKET	1.000000	Piece	S
24>	436-L32AB0I-01S	TERMINAL SHEET FOR "ILO"	1.000000	Piece	S
25>	481-L32AB06-01S	SHIELDING BOTTOM MT8202	1.000000	Piece	S
26>	483-L32AB32-01S	SHIELDING COVER	1.000000	Piece	S
27>	486-L32AD01-01	NAME PLATE ILO SILVER/BLACK	1.000000	Piece	S
28>	521-300055-01	FELT PAPER 300X5X0.5MM	4.000000	Piece	S
29>	560-L32AD01-01AP	MODEL LABEL ILO LCT3285TA P	1.000000	Piece	S
30>	563-119-	SERIAL NO. LABEL	1.000000	Piece	S
31>	568-P46T02-02	WARNING LB ENG 42SF NIL	1.000000	Piece	S
32>	578-L32AD01-03AP	FUNCTION SHEET LABEL FOR S-MT8202 ILO	1.000000	Piece	S
33>	579-42D102-09	SERIAL NO/BAR CODE LABEL 42D1	1.000000	Piece	S
34>	579-42D105-01	PROTECTIVE EARTH LABEL FOR ESA 42TD1	1.000000	Piece	S
35>	579-L27AD09-01	CAUTION LABEL ENG AKAI	1.000000	Piece	S
36>	579-L32AD02-06AP	BAR CODE W/SERIAL NO. LABEL 60X40MM LCT32HA36	2.000000	Piece	S
37>	579-L32AD09-02AP	FCC STATEMENT LABEL 77X20MM	1.000000	Piece	S
38>	590-L32AD01-04AP	WARRANTY CARD ILO	1.000000	Piece	S

39>	593-L32AD01-07AP	INSERTION CARD ILO	1.000000	Piece	S
40>	E3404-157010	AC CORD UL 1.88M FOR MT8202 (W/O FILTER)	1.000000	Piece	S
41>	E3421-925118	WIRE ASSY 8P2.5/7P2.0 L170MM 5V 12V SIGNAL POWER MT8202	1.000000	Piece	S
42>	E3421-925119	WIRE ASSY P2.5 11P/11P L400MM 5V SIGNAL POWER MT8202	1.000000	Piece	S
43>	E3421-925127	WIRE ASSY TJC3-2Y L860 SPK-R MT8202	1.000000	Piece	S
44>	E3421-925133	WIRE ASSY TJC3-3Y L650 SPK-L MT8202	1.000000	Piece	S
45>	E3421-925145	WIRE ASSY 10P/10P 2.5/2.5 L400MM 12V/9V MT8202	1.000000	Piece	S
46>	E3421-926125	WIRE ASSY P2.5 4P/4P L400MM AMP24V EMI MT8202	1.000000	Piece	S
47>	E3461-064038	WIRE ASSY P2.5 7P/7P L400MM 5V STANBY POWER MT8202 FOR 27"/32" LCD	1.000000	Piece	S
48>	E3461-064043	WIRE ASSY P2.0/12P/3P2.0/8P2.5 L400MM L700MM INVERTER MT8202	1.000000	Piece	S
49>	E3471-000047	WIRE WS SHIELD WIRE FOR 32LCD TV+COMBO DVD MICO & CMO	1.000000	Piece	S
50>	E3471-000072	WIRE WS SHIELD FOR MT8202 MICO KEY 13P/8P+5P L650/L750MM W/O EMI	1.000000	Piece	S
51>	E4801-124001	SPEAKER 8 OHM 10W D3" YD78-1	2.000000	Piece	S
52>	E6203-32CD01	DISPLAY LCD 32" CMO WXGA V320B1-L01	1.000000	Piece	S
53>	E7301-010002	BATTERY AAA R03P1.5V <2>	2.000000	Piece	S
54>	734-L32AD02-02	PLASTIC BASE ASS'Y W/O LOGO SILVER	1.000000	SET	S
55>	771BL27AD01-02	IR RECEIVE PCB ASS'Y FOR "ILO" LCD S-MT8202	1.000000	SET	S
56>	771KL37AD01-01	KEY PCB ASSY FOR LCT37AD	1.000000	SET	S

Spare part list for LCT32HA36

Item	Part Number	Part Description	Usage / unit	Unit	Key/Spare
	LCT32ADAIA1CS-F01	ILO LCT32AD(LCT32HA36) S-MT8202 CMO(V320B1-L06 V2.1) AC120V/60HZ USA SILVER/BLACK			
1>	510-L32AD01-13AK	CARTON BOX ILO LCT32HA36 CMO PANEL K	1.000000	Piece	K
2>	580-L32AD2A-05AP	IB E FOR ILO LCT32HA36 TV+DTV CMO S-MT8202 USA	1.000000	Piece	K
3>	E3407-081001	CORD FFC P0.5 50P L=110 B-0.5-50X110-4(8)X4(8)-0.3X0.035	1.000000	Piece	K
4>	E7501-056104	REMOTE CONTROL K001 "ILO" 44KEYS MT8202 LCD TV USA BLACK	1.000000	SET	K
5>	E7801-P02002	PCB ASSY PSU BOARD MEGMEET MLT169 FOR 32LCD AC110-240V OUTPUT 12V/8V/24V 220W	1.000000	SET	K
6>	771EL27AD04-04	PCB ASS'Y MAIN S-MT8202 FOR LCT27"	1.000000	SET	K
7>	771SL27AD01-01	ATSC TUNER PCB ASS'Y (MT5111CE) W/O MAX3232/SPOIF	1.000000	SET	K
8>	200-L32AD04-01AA	CABINET FRONT 32" LCT32AD SIL/ BLK A	1.000000	Piece	S
9>	202-L32AD32-01AA	BACK CABINET BLACK W/O DVD	1.000000	Piece	S
10>	206-L32AD01-01R	SPK CABINET BACK BLACK	1.000000	Piece	S
11>	277-L32AD11-01S	FUNCTION KEY SIL(MATERIAL: BLACK) LCT32SD	1.000000	Piece	S
12>	300-L32AD08-01C	POLYFOAM LEFT TOP LCT32AD	1.000000	Piece	S
13>	300-L32AD09-01C	POLYFOAM RIGHT TOP LCT32AD	1.000000	Piece	S
14>	300-L32AD0A-01C	POLYFOAM LEFT BOTTM LCT32AD	1.000000	Piece	S
15>	300-L32AD0B-01C	POLYFOAM RIGHT BOTTOM LCT32AD	1.000000	Piece	S
16>	310-030404-01	POLYBAG 110MMX80MMX0.04MM	1.000000	Piece	S
17>	310-041204-01V	POLYBAG 4"X12"X0.04 AV	1.000000	Piece	S
18>	310-111404-07V	POLYBAG 11"X14"X0.04 FV	1.000000	Piece	S

19>	310-423850-07V	BAG LAMIFILM 42"X38"X0.5MM	1.000000	Piece	S
20>	370-42D102-01	PAD CORD SPONG FOR SPK	1.000000	Piece	S
21>	384-L32AD03-01H	PVC SHEET FOR KEY	1.000000	Piece	S
22>	389-L32AB01-01	PVC SHEET L32AB	2.000000	Piece	S
23>	426-L37AD01-01S	AC LINE BRACKET	1.000000	Piece	S
24>	436-L32AB0I-01S	TERMINAL SHEET FOR "ILO"	1.000000	Piece	S
25>	481-L32AB06-01S	SHIELDING BOTTOM MT8202	1.000000	Piece	S
26>	483-L32AB32-01S	SHIELDING COVER	1.000000	Piece	S
27>	486-L32AD01-01	NAME PLATE ILO SILVER/BLACK	1.000000	Piece	S
28>	521-300055-01	FELT PAPER 300X5X0.5MM	4.000000	Piece	S
29>	522-421D01-01	MASKING PAPER	1.000000	Piece	S
30>	560-L32AD01-01AP	MODEL LABEL ILO LCT3285TA P	1.000000	Piece	S
31>	563-119-	SERIAL NO. LABEL	1.000000	Piece	S
32>	568-P46T02-02	WARNING LB ENG 42SF NIL	1.000000	Piece	S
33>	578-L32AD01-03AP	FUNCTION SHEET LABEL FOR S-MT8202 ILO	1.000000	Piece	S
34>	579-42D102-09	SERIAL NO/BAR CODE LABEL 42D1	1.000000	Piece	S
35>	579-42D105-01	PROTECTIVE EARTH LABEL FOR ESA 42TD1	1.000000	Piece	S
36>	579-L27AD09-01	CAUTION LABEL ENG AKAI	1.000000	Piece	S
37>	579-L32AD02-06AP	BAR CODE W/SERIAL NO. LABEL 60X40MM LCT32HA36	2.000000	Piece	S
38>	579-L32AD09-02AP	FCC STATEMENT LABEL 77X20MM	1.000000	Piece	S

39>	590-L32AD01-04AP	WARRANTY CARD ILO	1.000000	Piece	S
40>	593-L32AD01-10AP	INSERTION CARD ILO LCT32HA36	1.000000	Piece	S
41>	E3404-157010	AC CORD UL 1.88M FOR MT8202 (W/O FILTER)	1.000000	Piece	S
42>	E3421-925118	WIRE ASSY 8P2.5/7P2.0 L170MM 5V 12V SIGNAL POWER MT8202	1.000000	Piece	S
43>	E3421-925119	WIRE ASSY P2.5 11P/11P L400MM 5V SIGNAL POWER MT8202	1.000000	Piece	S
44>	E3421-925127	WIRE ASSY TJC3-2Y L860 SPK-R MT8202	1.000000	Piece	S
45>	E3421-925133	WIRE ASSY TJC3-3Y L650 SPK-L MT8202	1.000000	Piece	S
46>	E3421-925145	WIRE ASSY 10P/10P 2.5/2.5 L400MM 12V/9V MT8202	1.000000	Piece	S
47>	E3421-926125	WIRE ASSY P2.5 4P/4P L400MM AMP24V EMI MT8202	1.000000	Piece	S
48>	E3461-000123	WIRE ASSY 14P/3P2.0/8P2.5 L=400/700MM INVERTER V320B1-L04/06(PANEL)	1.000000	Piece	S
49>	E3461-064038	WIRE ASSY P2.5 7P/7P L400MM 5V STANBY POWER MT8202 FOR 27"/32" LCD	1.000000	Piece	S
50>	E3471-000072	WIRE WS SHIELD FOR MT8202 MICO KEY 13P/8P+5P L650/L750MM W/O EMI	1.000000	Piece	S
51>	E3471-000082	WIRE WS SHIELD WIRE FOR 32LCD COM(V320B1-L04/06) LVDS S-MT8202	1.000000	Piece	S
52>	E4801-124001	SPEAKER 8 OHM 10W D3" YD78-1	2.000000	Piece	S
53>	E6203-32CD03	DISPLAY LCD 32" CMO WXGA V320B1-L06	1.000000	Piece	S
54>	E7301-010002	BATTERY AAA R03P1.5V <2>	2.000000	Piece	S
55>	734-L32AD02-02	PLASTIC BASE ASS'Y W/O LOGO SILVER	1.000000	SET	S
56>	771BL27AD01-02	IR RECEIVE PCB ASS'Y FOR "ILO" LCD S-MT8202	1.000000	SET	S
57>	771KL37AD01-01	KEY PCB ASSY FOR LCT37AD	1.000000	SET	S

Software Upgrade

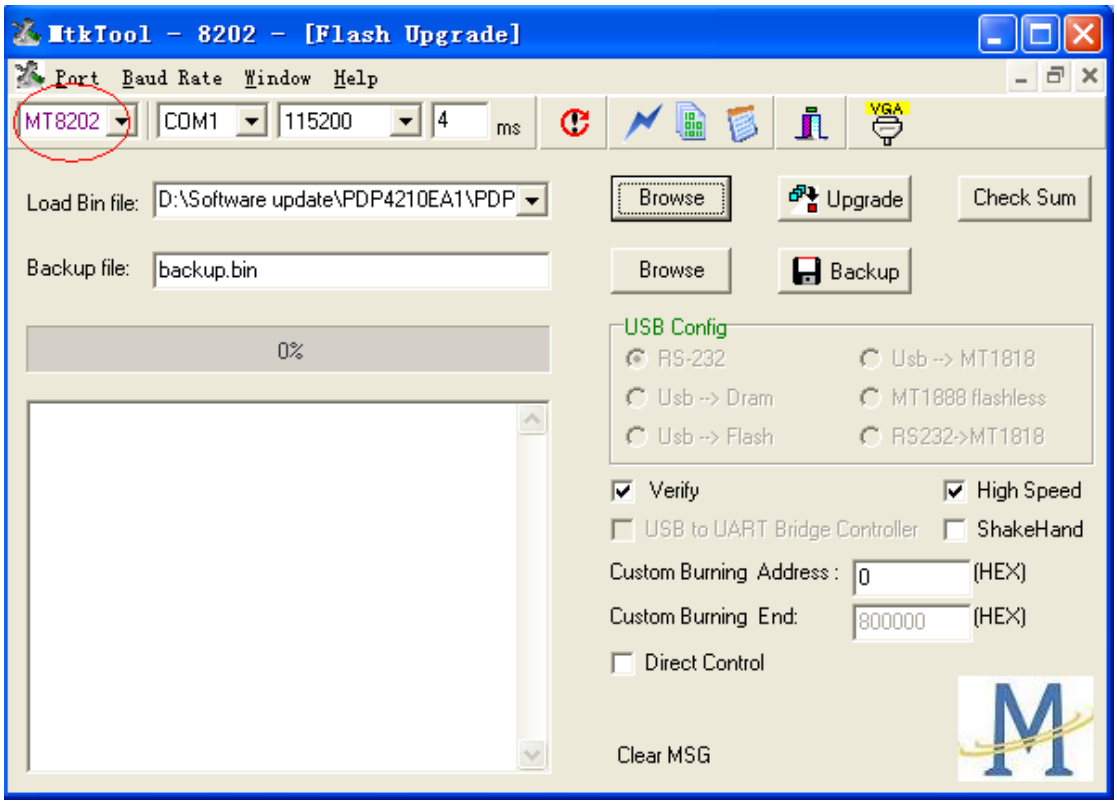
Process of update MT8202

Preparing :

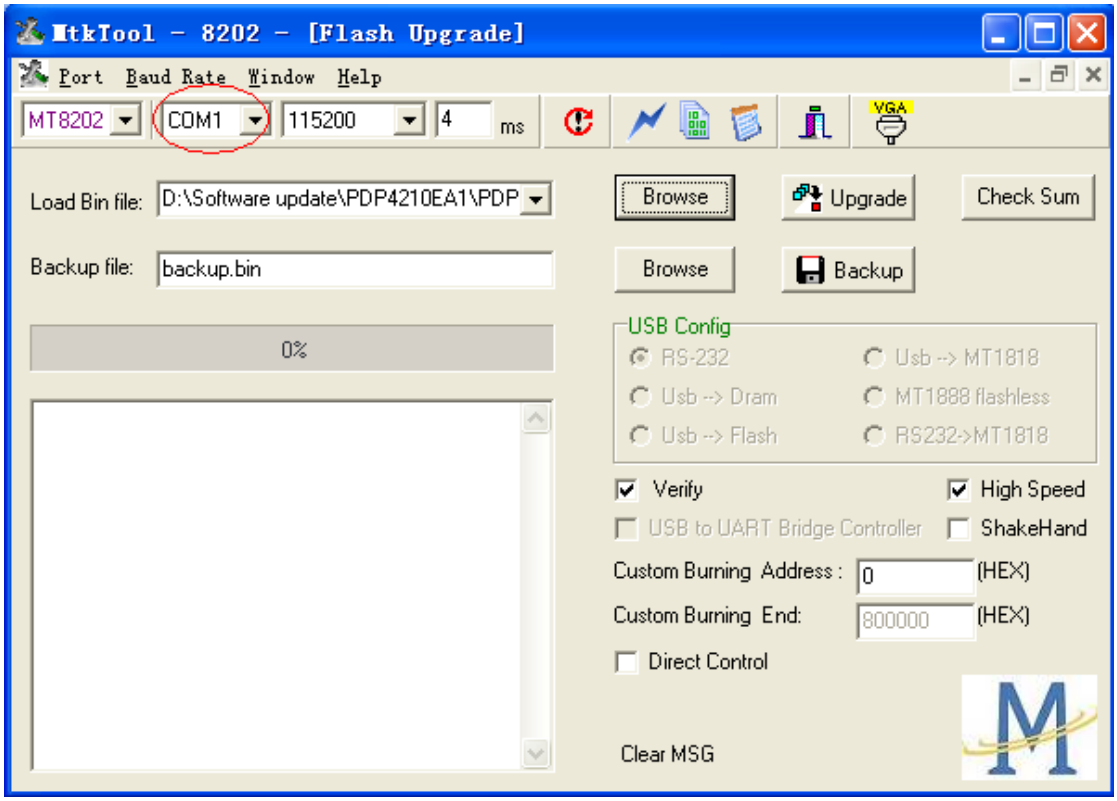
1. Connect the Plasma/LCD TV and PC with the **Software Upgrade Board**.Please find the details for connecting **refering to the appendix at the end of this file.**
2. Store the MtkTool into the PC .

Downloading :

3. Turn on AC power of the TV and then press the button “standby” of the remote control . The image could be found on the screen of the Plasma TV while the color of the power indicator is green . (the mode of the TV will be standby mode if after turn on the main power only .)
4. Execute MTKtool and select the chipset as MT8202. (the software of MTKtool will be sent to your side)

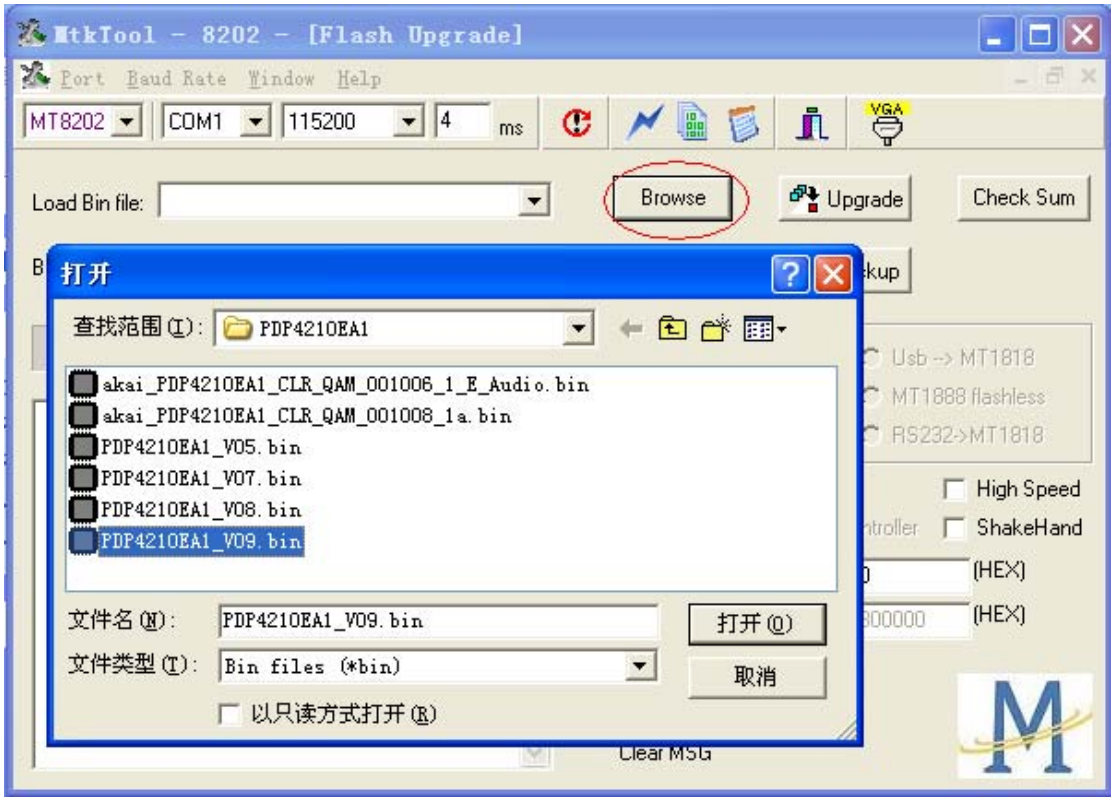


5. Select current COM port. (please try to check the COM port of your PC).

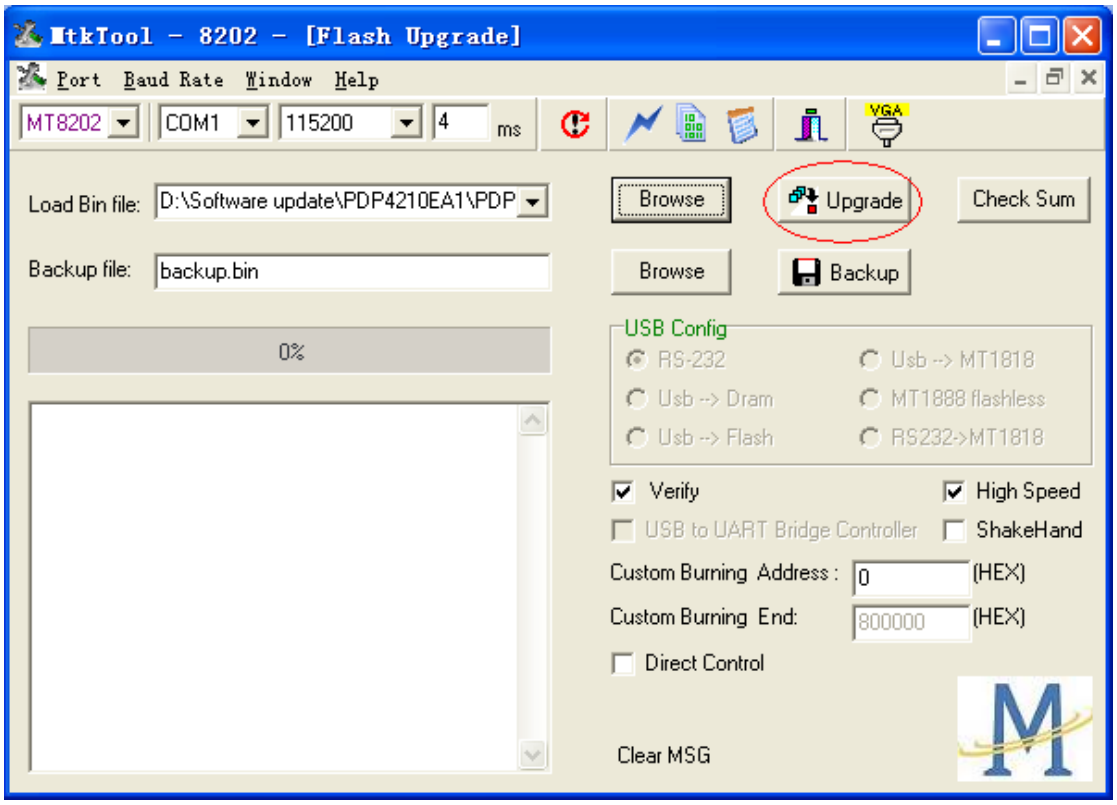


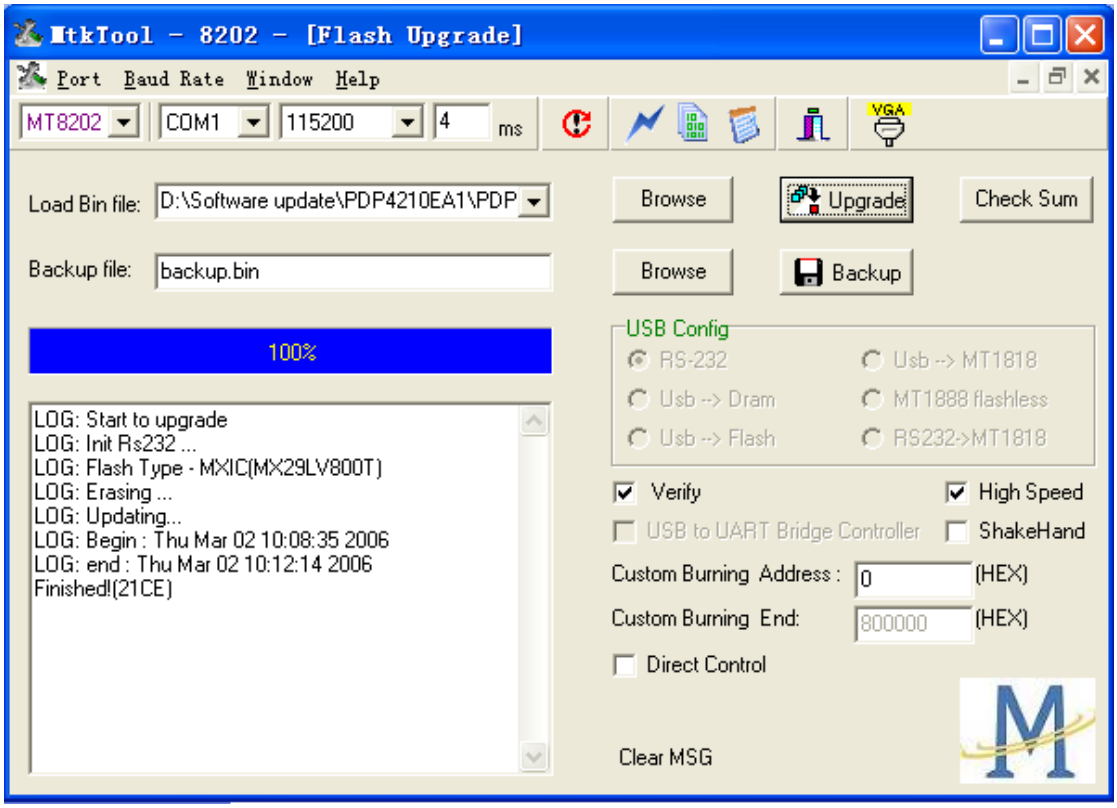
6. Choose the bit rate as 115200.

7. Select the update binary by pressing browse button. For example,the binary file name is PDP4210EA1_V09.bin. (this update firmware will be sent to your side)



8. Press Upgrade button and start update process.





9. The update process is successful as the progress bar is 100%. After the update process is ok,

turn off power and wait indicator light is off. Turn on power and TV can work.

Checking

It is needed to check the version of the firmware for MT8202 which has been download into the Plasma TV .

Press Menu button of the remote control，following input “8202”of the remote control and OSD menu for Factory Setting is appeared on the screen .

Use the remote control and select the mode of Firmware Version and then enter the mode of Firmware Version . It is easy to be found the version of the current firmware for MT8202 is as the following : “Factory ID : PDP4210EA1_VXX ”

Appendix:

Quick Installation Guide

For

Software Upgrade Board

1. Parts List

- Software upgrade board x 1 (#1)
- RS232 null cable x 1 for PC (#2)
- RS232 – VGA cable (#4)
- USB cable x 1 (#5)

2. Installation for ATV upgrade

2.1 Connect RS232 cable (#2) to PC serial port

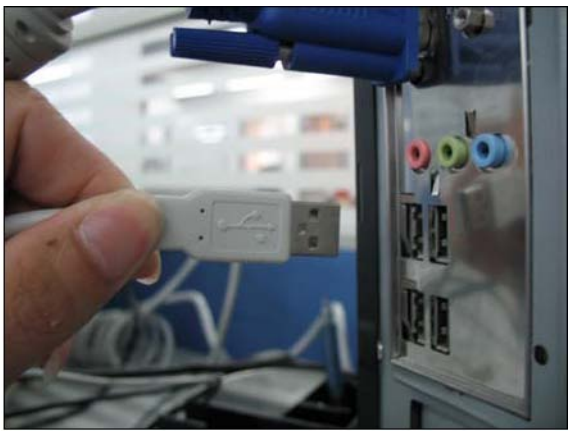
Connect another side of RS232 cable (#2) to the board (#1)

2.2 Connect RS232-VGA cable (#4) (RS232 side) to the board (#1)

Connect RS232-VGA cable (#4) (VGA side) to the TV

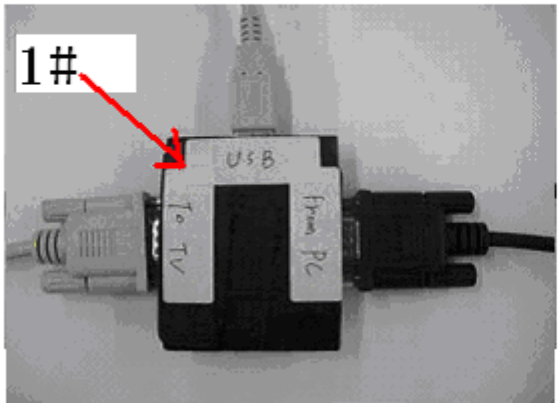
2.3 Connect USB cable (#5) to the board (#1)

Connect another side of USB cable (#5) to PC

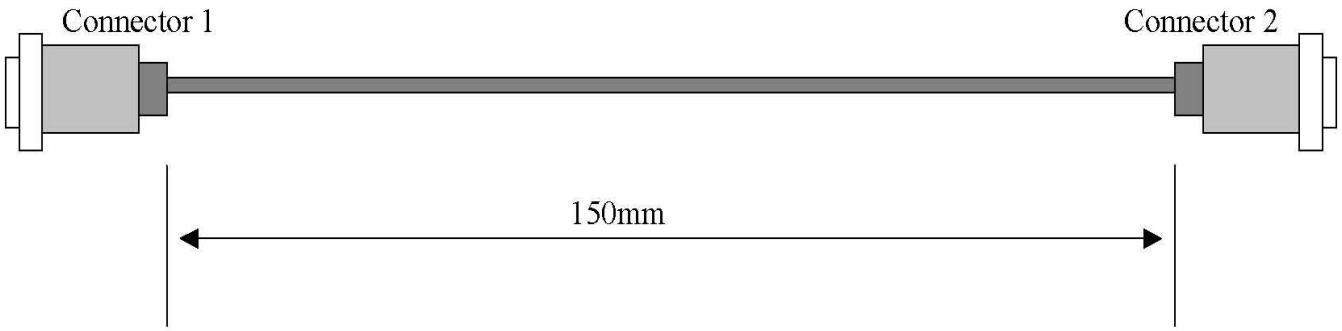


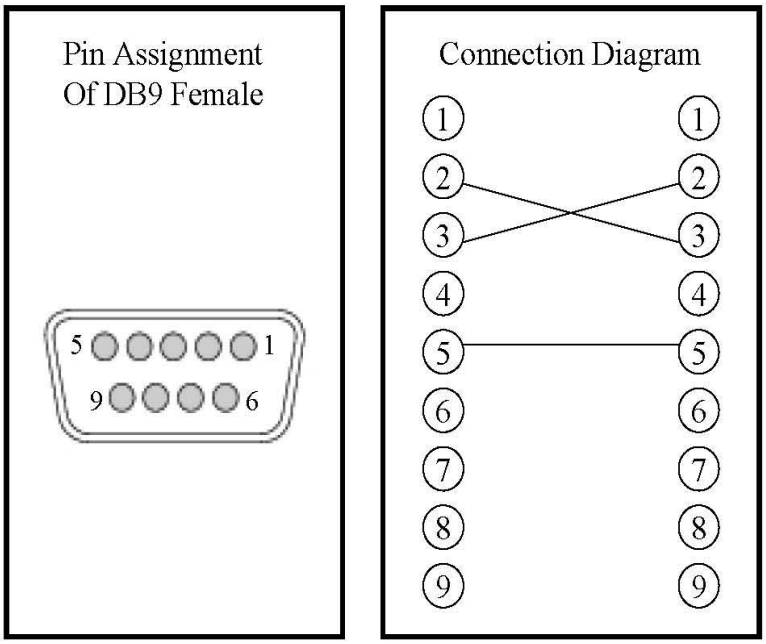
3. Cables Standard for Upgrade Board

Software upgrade board x 1 (#1)



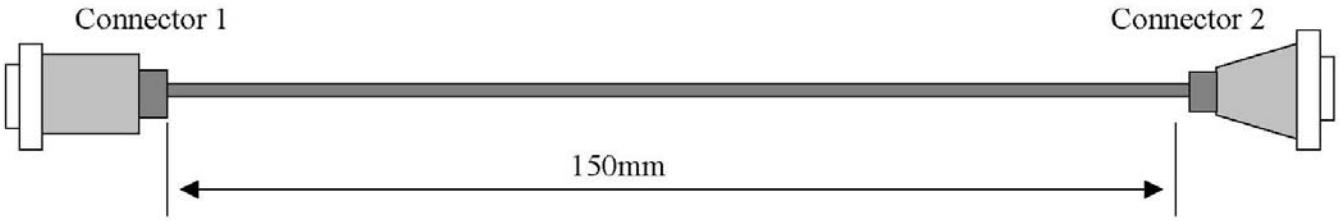
RS232 Null Cable for PC (#2)

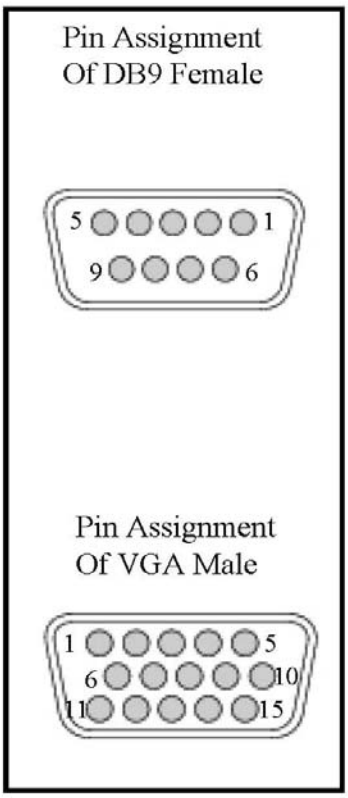


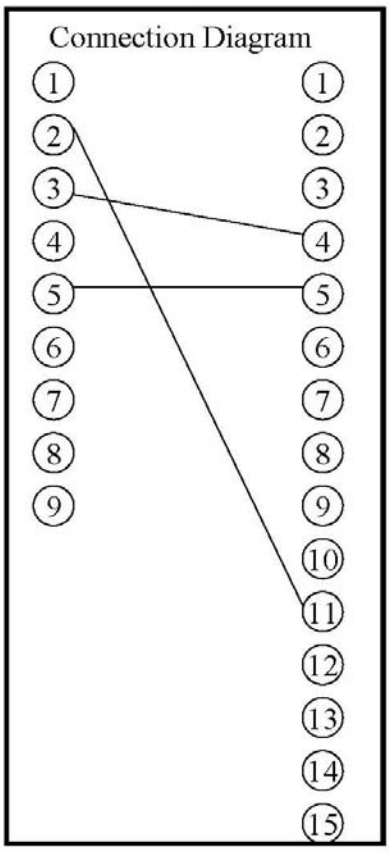


Connector 1: DB9 Female
Connector 2: DB9 Female

RS232 - VGA Cable (#4)

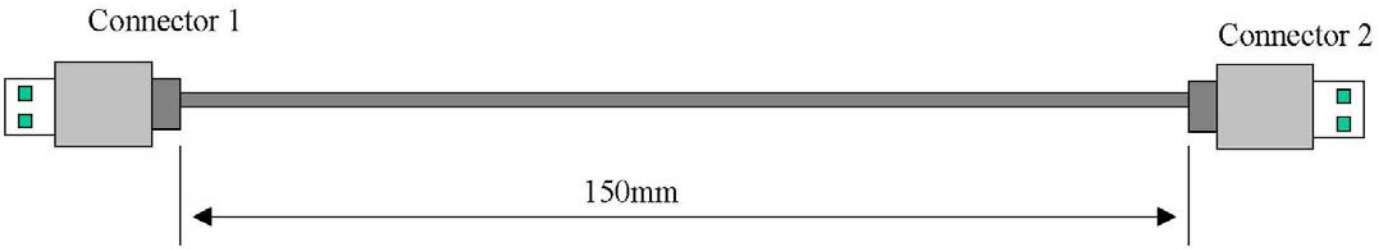






Connector 1: DB9 Female
Connector 2: VGA Male

USB Cable (#5)



Connector 1: Standard USB Male
Connector 2: Standard USB Male

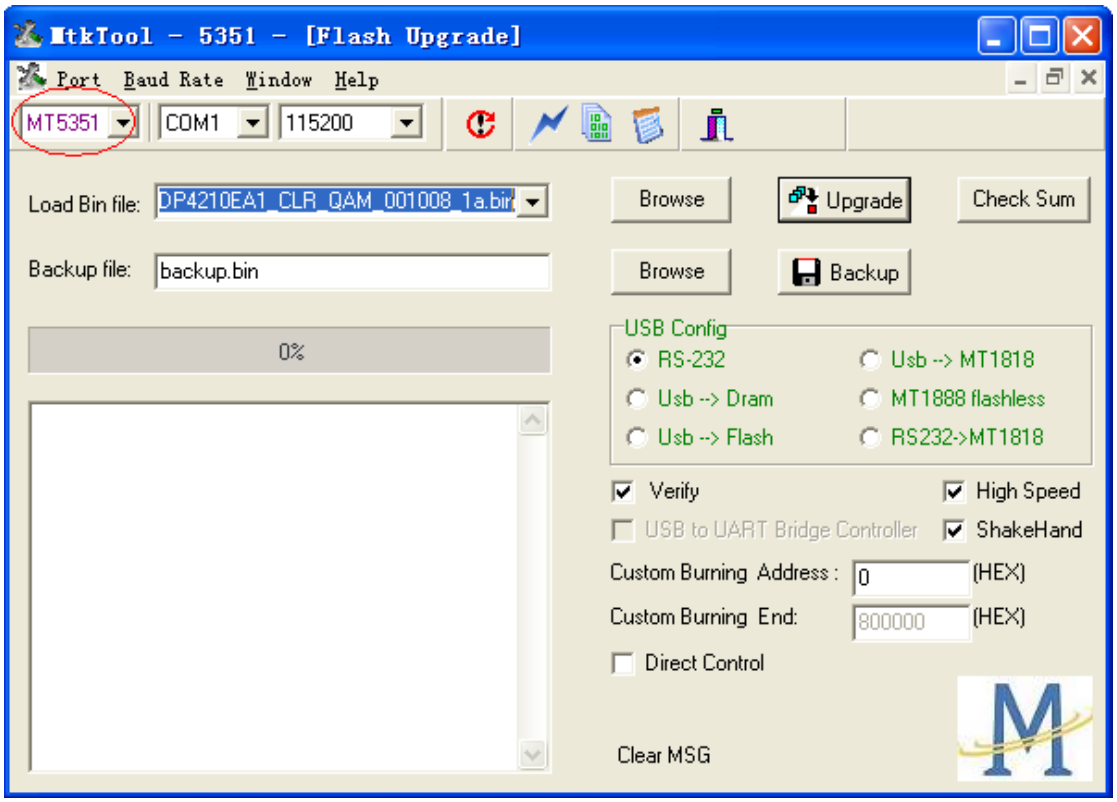
Process of update MT5351AG

Preparing :

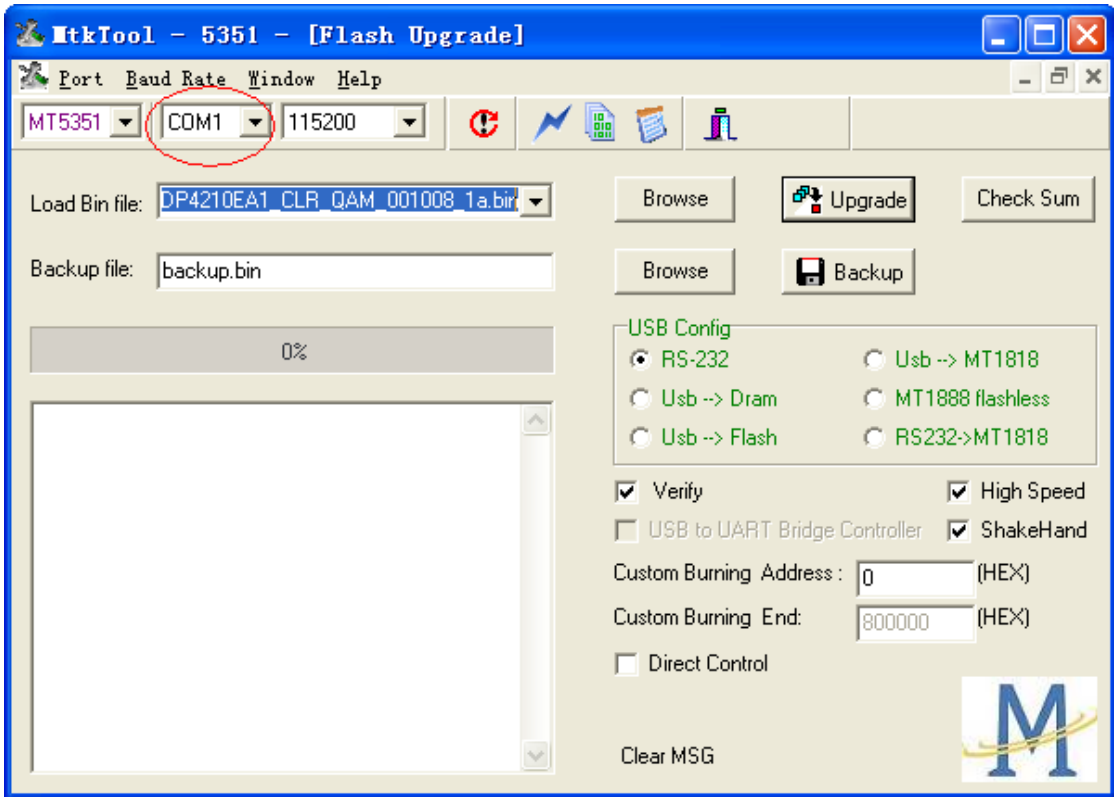
1. Connect the Plasma/LCD TV and PC with the **Software Upgrade Board**.Please find the details for connecting **refering to the appendix at the end of this file.**
2. Store the MtkTool into the PC

Downloading :

3. Turn on AC power of the TV and then press the button “standby” of the remote control . The image could be found on the screen of the Plasma TV while the color of the power indicator is green . (the mode of the TV will be standby mode if after turn on the main power only .)
4. Execute MTKtool and select the chipset as MT5351. (the software of MTKtool will be sent to your side)

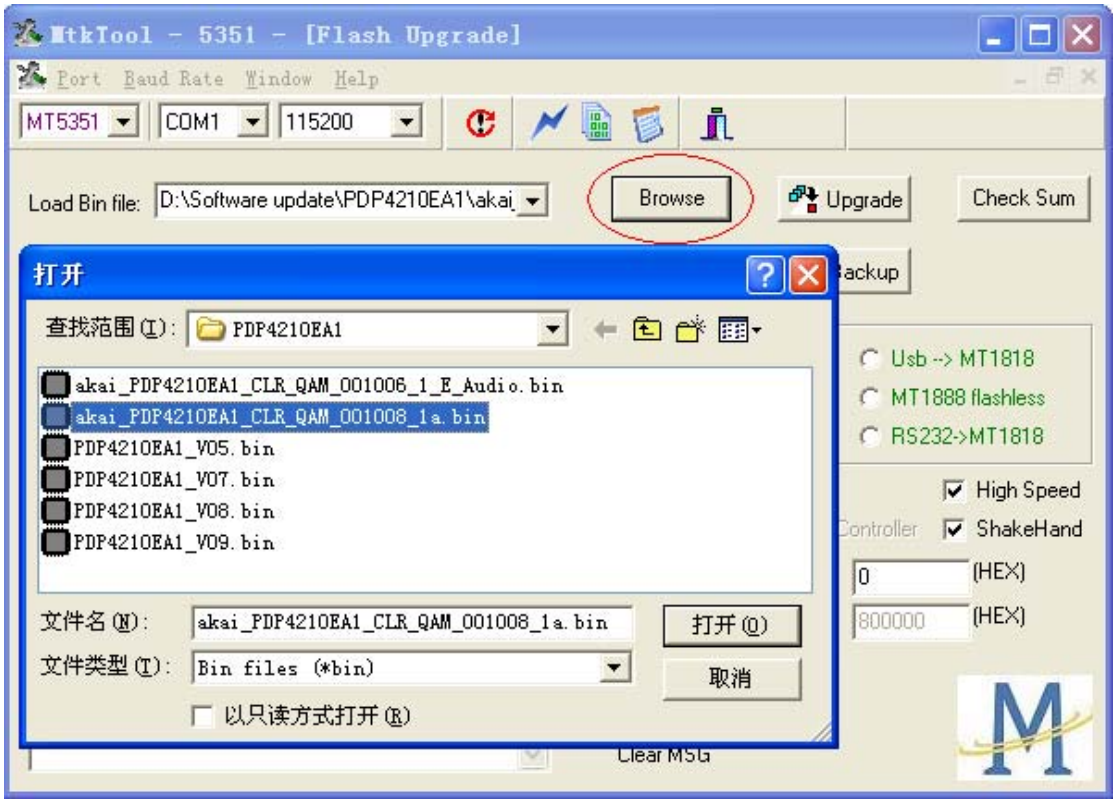


5. Select current COM port. (please try to check the COM port of your PC).

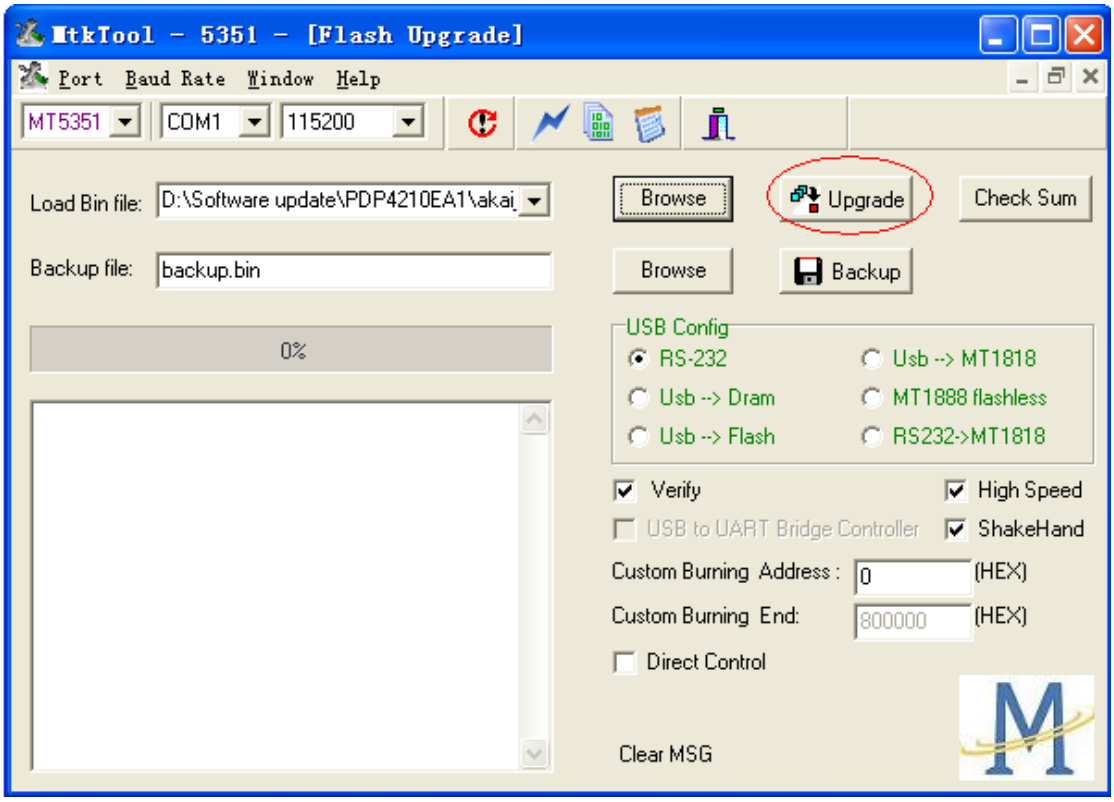


6. Choose the bit rate as 115200.

7. Select the update binary by pressing browse button. For example,the binary file name is XXXX_PDP4210EA1_000000XX_X_P.bin. (this update firmware will be sent to your side)



8. Press Upgrade button and start update process.



9. The update process is successful as the progress bar is 100%. After the update process is ok, turn off power and wait indicator light is off. Turn on power and TV can work.

Checking :

It is needed to check the version of the firmware for MT5351AG which has been download into the Plasma TV .

Press Menu button of the remote control and the main OSD menu is appeared on the screen .

Use the remote control and select the DTV menu . following input “0000” (zero , zero , zero , zero) of the remote control .Then enter the mode of factory after input the digits .

It is easy to be found the version of the current firmware for MT5351AG is “PDP4210EA1 CLA_QAM_XXXXXX_XX”under the mode of factory .

Appendix:

Quick Installation Guide

For

Software Upgrade Board

1. Parts List

- Software upgrade board x 1 (#1)
- RS232 null cable x 1 for PC (#2)
- RS232 null cable x 1 for DTV (#3)
- USB cable x 1 (#5)

2. Installation for DTV upgrade

2.1 Connect RS232 cable (#2) to PC serial port

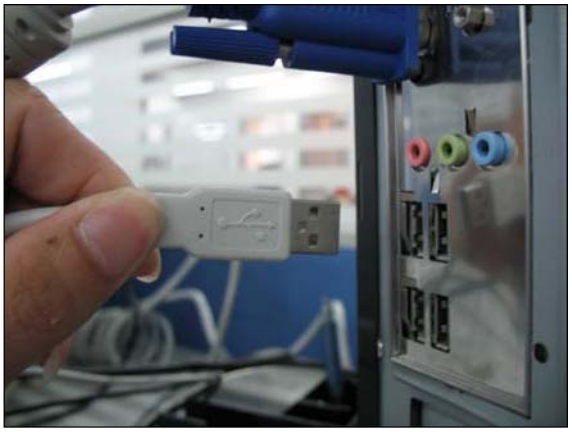
Connect another side of RS232 cable (#2) to the board (#1)

2.2 Connect RS232 cable for DTV (#3) to the board (#1)

Connect another side of RS232 cable for DTV (#3) to the TV

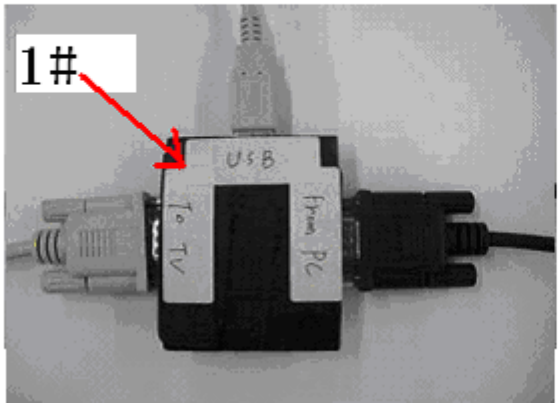
2.3 Connect USB cable (#5) to the board (#1)

Connect another side of USB cable (#5) to PC

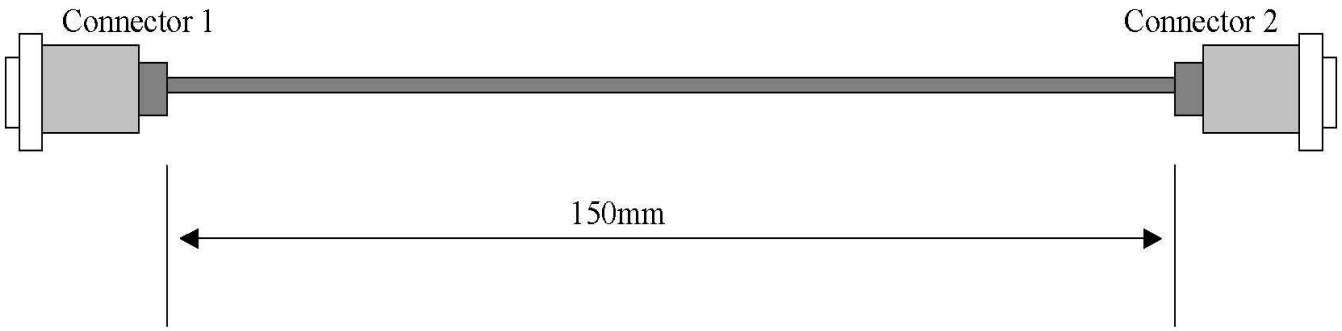


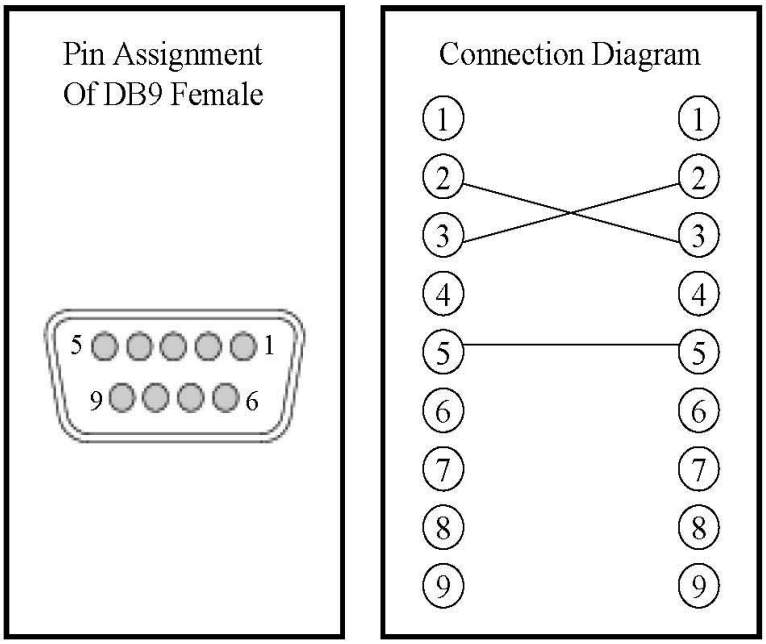
3. Cables Standard for Upgrade Board

Software upgrade board x 1 (#1)



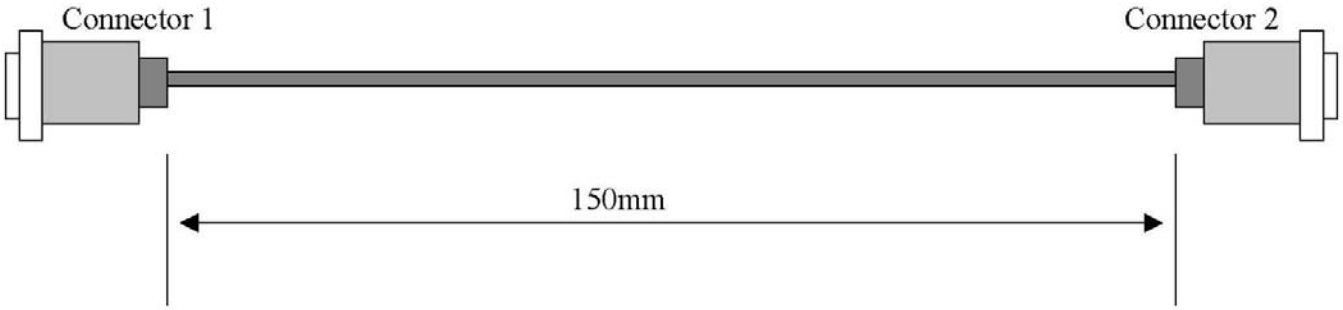
RS232 Null Cable for PC (#2)

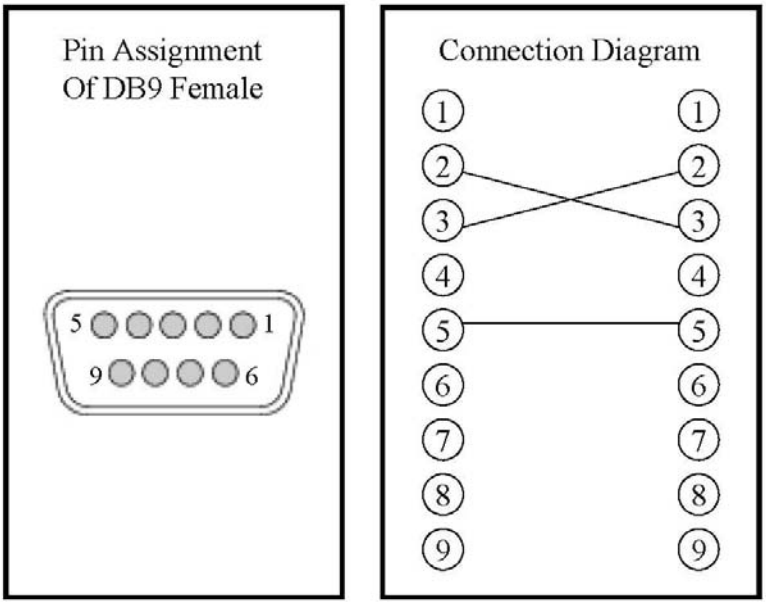




Connector 1: DB9 Female
Connector 2: DB9 Female

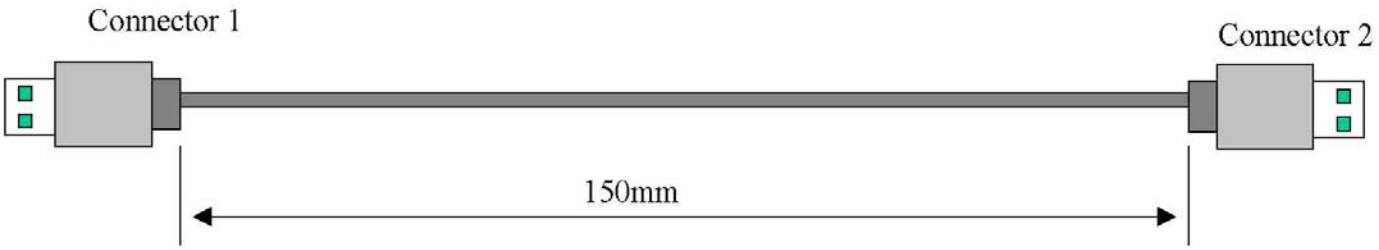
RS232 Null Cable for DTV (#3)





Connector 1: DB9 Female
Connector 2: DB9 Female

USB Cable (#5)



Connector 1: Standard USB Male
Connector 2: Standard USB Male